Annual Forum 2015
São Paulo, Brazil  July 27-31

Rethinking Mobility

Reconfigurable Shared-Use Mobility Systems
2015 Global Annual Forum

“Rethinking Mobility”

July 27 – July 30, 2015
University of São Paulo
São Paulo, Brazil
# PACE 2015 Global Annual Forum

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Contact Numbers

Emergency, Hotels, Forum Hosts & GM PACE Office Contacts

University of São Paulo, Monica Guerra 55 11-3091-5332
Professor Marcelo Alves (USP) 55 11 9-9261-7589
Plinio Cabral Jr. (GM Brazil) 55 11 999760478
Antonio Santos Junior (GM Brazil) 55 11 993801212
Vanessa Arnon (GM Brazil) 55 11 970560122
Vass Theodoracatos (PACE Office) 001 586-291-8001
Laura McCausland (PACE Office) 001 248-758-8567
Nancy Neikirk (PACE Office) 001 586-899-6802
Go Inn Jaguaré 55 11 3716-2656
Quality Hotel Faria Lima 55 11 2197-7050
George V Alto de Pinheiros 55 11 3030-0700

Wi-Fi Internet Access

The University of São Paulo will provide Internet access information for all attendees.
Welcome to the 2015 PACE Global Annual Forum!

Welcome to the 2015 PACE Global Annual Forum! This year, our forum is in beautiful São Paulo, Brazil on the campus of the University of São Paulo (USP). This is the first forum that will be held south of the Equator and during the winter. Our hosts from USP and GM do Brasil have worked tirelessly for the past year planning and executing all the details to ensure your week is rewarding.

“Rethinking Mobility” is the theme of this year’s forum which fits well with the challenge of the RSMS PACE Global Project Competition. The RSMS project challenges the project teams to develop a Reconfigurable Shared-Use Mobility System concept including research, market assessment, design process and one final design proposal in year one of this two-year project competition. The project addresses the future of urban ground transportation for megacities and is looking for innovative sustainable transportation options addressing reconfigurability for a variety of passenger vehicle and cargo needs. This year’s competition will be the first time that includes a Design Review component, following a similar format as design reviews done in industry.

Over the last 16 years PACE has grown from a single institution in 1999 to 65 institutions in 12 countries in 2015. The PACE vision has been sustained through the high degree of commitment of the partners, contributors, and supporters to the PACE institutions and students. PACE is playing a key role in developing and retaining world-class talent with the technical design and engineering capability true to its mission of developing the Product Lifecycle Management (PLM) team of the future.

At the PACE Forum Awards Celebration Dinner we will celebrate all of our accomplishments of 2015 and look to the future as PACE continues with its mission through its partners, supporters, faculty and students as they engage and collaborate on building future project lifecycle management teams.

We are pleased you are here to participate, network, collaborate and celebrate with other faculty, students and PACE company representatives in this learning environment. We look forward to this week in São Paulo, Brazil and the opportunity to share with you many interesting and worthwhile forum sessions.

PACE is what you make of it!

The PACE Core Team:
Vass Theodoracatos, GM
Horst Vogt, Autodesk
Jan Deyton, HP Enterprise Services
Hulas King, Siemens PLM Software
Keith Rajecki, Oracle
Cirquinho classroom building as seen from bus stop.

Escola Politécnica da Universidade de São Paulo campus statue.
Our sincere thanks to the Hosts of the 2015 PACE Annual Forum

The facilities, breaks, lunches, and dinners provided during the PACE Annual Forum are possible thanks to the generosity of the Sponsors.
Our sincere thanks to the

Sponsors of the 2015 PACE Annual Forum

Diamond Level Sponsors

GM

AUTODESK

SIEMENS
Our sincere thanks to the

**Sponsors** of the 2015 PACE Annual Forum

**Gold Level Sponsors**

[Logo of Oracle]

**Silver Level Sponsors**

[Logo of CD-adapco]

[Logo of Synopsys]
## Forum Agenda “At-a-Glance”

### Sunday, July 26 – Conference Check-In & Welcome Reception

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:30-4:30</td>
<td><strong>Early Conference Check-in</strong>&lt;br&gt;Mechanical Engineering Building, outside the Welcome Reception entrance</td>
</tr>
<tr>
<td>4:00 – 6:30</td>
<td><strong>Welcome Reception</strong>&lt;br&gt;University of São Paulo&lt;br&gt;Av. Prof. Mello Moraes 2231&lt;br&gt;São Paulo, SP 05508-900 Brazil</td>
</tr>
</tbody>
</table>

### Monday, July 27 – PACE RSMS Project Competition Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td><strong>Conference Check-In and Information</strong>&lt;br&gt;University of São Paulo&lt;br&gt;Av. Prof. Almeida Prado, travessa 2, nº 158&lt;br&gt;Cidade Universitária – Butantã – São Paulo – SP, 05508-010&lt;br&gt;• Sign up in advance for Tuesday University of Sao Paulo Laboratory Tours&lt;br&gt;• Sign up to attend Tuesday Office Hours with the PACE Forum Sponsors</td>
</tr>
<tr>
<td>All Day</td>
<td><strong>PACE Company Display Expo</strong>&lt;br&gt;Open area outside the Jose Augusto Martins Auditorium</td>
</tr>
<tr>
<td>8:00 – 12:00</td>
<td>Poster Authors – Posters are due TODAY at the information table.</td>
</tr>
<tr>
<td>10:00</td>
<td><strong>2015 PACE Global Annual Forum Opening Session</strong>&lt;br&gt;J.O. Monteiro de Camargo Building (known as Biênio)&lt;br&gt;Jose Augusto Martins Auditorium&lt;br&gt;University of São Paulo</td>
</tr>
<tr>
<td>10:00 – 10:05</td>
<td>Welcome and Announcements&lt;br&gt;Master of Ceremonies: Alisson Sarmento, Manager, GM do Brasil Engineering Operations and Systems Development, GM</td>
</tr>
<tr>
<td>10:05 – 10:10</td>
<td>Welcome from PACE&lt;br&gt;Vassilios Theodoracatos, Manager, Global PACE Partnerships, GM</td>
</tr>
<tr>
<td>10:10 – 10:25</td>
<td>Welcome Remarks from University of São Paulo&lt;br&gt;Professor José Roberto Castilho Piqueira, Dean of Engineering, University of São Paulo</td>
</tr>
<tr>
<td>10:25 – 10:40</td>
<td>Welcome Remarks from General Motors Brazil&lt;br&gt;William Bertagni, GMSA PE Vice President, South America Engineering, General Motors</td>
</tr>
</tbody>
</table>
Forum Agenda “At-a-Glance”

Monday, July 27 – PACE RSMS Project Competition Day *(continued)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:40 – 10:50</td>
<td><strong>RSMS Project Introduction</strong>&lt;br&gt;Mo Omari, Global Manufacturing Engineering – ME Functional Lead</td>
</tr>
<tr>
<td>10:50 – 11:20</td>
<td><strong>RSMS Team Project Presentation – Team A</strong></td>
</tr>
<tr>
<td>11:25 – 11:45</td>
<td><strong>Morning Break</strong> – Area outside José Augusto Martins Auditorium</td>
</tr>
<tr>
<td>11:45 – 12:15</td>
<td><strong>RSMS Team Project Presentation – Team B</strong></td>
</tr>
<tr>
<td>12:25 – 12:55</td>
<td><strong>RSMS Team Project Presentation – Team C</strong></td>
</tr>
<tr>
<td>1:00 – 2:00</td>
<td><strong>Lunch</strong> – Outside Auditorium, Box Lunch</td>
</tr>
<tr>
<td>2:00 – 2:30</td>
<td><strong>GM Keynote Speaker:</strong>&lt;br&gt;&lt;br&gt;<strong>Rethinking Mobility: Driving the Future</strong>&lt;br&gt;Ken Kelzer, Vice President Global Vehicle Components and Subsystems, General Motors</td>
</tr>
<tr>
<td>2:40 – 3:10</td>
<td><strong>RSMS Team Project Presentation – Team D</strong></td>
</tr>
<tr>
<td>3:20 – 3:50</td>
<td><strong>RSMS Team Project Presentation – Team E</strong></td>
</tr>
<tr>
<td>3:55 – 4:20</td>
<td><strong>Afternoon Break</strong> – Area outside Jose Augusto Martins Auditorium</td>
</tr>
<tr>
<td>4:20 – 4:50</td>
<td><strong>RSMS Team Project Presentation – Team F</strong></td>
</tr>
<tr>
<td>5:00 – 5:30</td>
<td><strong>RSMS Team Project Presentation – Team G</strong></td>
</tr>
<tr>
<td>5:40 – 6:10</td>
<td><strong>RSMS Team Project Presentation – Team H</strong></td>
</tr>
<tr>
<td>6:10 – 6:20</td>
<td><strong>Closing Remarks</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:20</td>
<td><strong>Busses depart for travel to hotels</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Delegates are “on your own” for dinner this evening</strong></td>
</tr>
</tbody>
</table>
Forum Agenda “At-a-Glance”

Tuesday, July 28 – PACE RSMS Project Competition Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td>Conference Check-In and Information</td>
</tr>
<tr>
<td>All Day</td>
<td>PACE Company Display Expo</td>
</tr>
<tr>
<td>All Day</td>
<td>PACE Poster Display – Atrium area</td>
</tr>
<tr>
<td>10:00 – 10:10</td>
<td>Welcome and Announcements</td>
</tr>
<tr>
<td>10:10 – 10:40</td>
<td>Connected Mobility that Enhances and Promotes a Sustainable World</td>
</tr>
<tr>
<td></td>
<td>Clay Dean, Director, Global Advanced Design, General Motors</td>
</tr>
<tr>
<td>10:40 – 10:55</td>
<td>Morning Break</td>
</tr>
<tr>
<td>10:55 – 1:00</td>
<td>RSMS Design Review Competition Team Presentations</td>
</tr>
<tr>
<td>10:55 – 11:05</td>
<td>Introduction</td>
</tr>
<tr>
<td>11:10 – 11:20</td>
<td>RSMS Design Review Presentation – Team A</td>
</tr>
<tr>
<td>11:25 – 11:35</td>
<td>RSMS Design Review Presentation – Team B</td>
</tr>
<tr>
<td>11:40 – 11:50</td>
<td>RSMS Design Review Presentation – Team C</td>
</tr>
<tr>
<td>11:55 – 12:05</td>
<td>RSMS Design Review Presentation – Team D</td>
</tr>
<tr>
<td>12:10 – 12:20</td>
<td>RSMS Design Review Presentation – Team E</td>
</tr>
<tr>
<td>12:25 – 12:35</td>
<td>RSMS Design Review Presentation – Team F</td>
</tr>
<tr>
<td>12:40 – 12:50</td>
<td>RSMS Design Review Presentation – Team G</td>
</tr>
<tr>
<td>12:55 – 1:05</td>
<td>RSMS Design Review Presentation – Team H</td>
</tr>
<tr>
<td>1:05 – 2:00</td>
<td>Lunch – Outside Auditorium, Box Lunch</td>
</tr>
</tbody>
</table>

Parallel activities are scheduled for Tuesday afternoon.

For all Forum Delegates, you may choose to:
- Visit the Company Display Expo and meet with PACE company representatives
- Attend a session with PACE Forum Sponsors during Office Hours
- Tour University of São Paulo laboratories, sign up in advance
- View the posters

For all RSMS team members, see next page for details of judges’ meetings.
**Forum Agenda “At-a-Glance”**

**Tuesday, July 28 – PACE RSMS Project Competition Day**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30 – 6:00</td>
<td><strong>RSMS Teams and judges meet for Q&amp;A sessions in the Central room of the Cirquinho (Round Classroom Building).</strong>&lt;br&gt;Teams waiting for their meeting time may visit the Company Display Expo, Company Office Hours or Poster Displays.&lt;br&gt;<em>10 minutes prior</em> to RSMS Team Meeting session, teams should gather in the designated area outside the Cirquinho Central Room.&lt;br&gt;Team meeting times are listed below.</td>
</tr>
</tbody>
</table>

| 1:30 – 2:00 | RSMS Team Q&A Session with Judges – Team A |
| 2:00 – 2:30 | RSMS Team Q&A Session with Judges – Team B |
| 2:30 – 3:00 | RSMS Team Q&A Session with Judges – Team C |
| 3:00 – 3:30 | RSMS Team Q&A Session with Judges – Team D |
| 3:30 – 4:00 | RSMS Team Q&A Session with Judges – Team E |

| 4:00 – 4:30 | **Afternoon Break** |
| 4:30 – 5:00 | RSMS Team Q&A Session with Judges – Team F |
| 5:00 – 5:30 | RSMS Team Q&A Session with Judges – Team G |
| 5:30 – 6:00 | RSMS Team Q&A Session with Judges – Team H |

| 6:00 – 6:20 | **RSMS Judges Wrap-Up** |

| 6:20 | **Busses depart for travel to hotels** |

|   | **Delegates are “on your own” for dinner this evening** |
Forum Agenda “At-a-Glance”

Wednesday, July 29 – PACE Global Annual Forum

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>All Day</td>
<td>Conference Check-In and Information</td>
</tr>
<tr>
<td>All Day</td>
<td>PACE Company Display Expo</td>
</tr>
<tr>
<td>All Day</td>
<td>PACE Poster Display</td>
</tr>
<tr>
<td>10:00 – 10:10</td>
<td>Welcome and Announcements</td>
</tr>
<tr>
<td>10:10 – 10:50</td>
<td><strong>NX User Experience</strong></td>
</tr>
<tr>
<td></td>
<td>Danny Sicking, Manager – NX UI Tools and Core Architecture,</td>
</tr>
<tr>
<td></td>
<td>Product Engineering, Siemens PLM Software</td>
</tr>
<tr>
<td>10:50 – 11:30</td>
<td><strong>Design For Six Sigma Methodology</strong></td>
</tr>
<tr>
<td></td>
<td>Dhana Radhakrishnan, Manager, GM Tech Center India</td>
</tr>
<tr>
<td></td>
<td>Engineering, General Motors India</td>
</tr>
<tr>
<td>11:30 – 11:50</td>
<td><strong>Morning Break</strong></td>
</tr>
<tr>
<td>11:50 – 1:00</td>
<td><strong>2015 PACE Collaboration and Innovation Challenge (CIC) Project</strong></td>
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<tr>
<td></td>
<td>Competition Finalists Presentations</td>
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<td></td>
<td>Dr. Delia J. Valles-Rosales, Associate Professor, New Mexico State</td>
</tr>
<tr>
<td></td>
<td>University</td>
</tr>
<tr>
<td>1:00 – 2:00</td>
<td><strong>Lunch</strong> – Outside Auditorium</td>
</tr>
</tbody>
</table>

*Parallel technical presentations are scheduled after lunch on Wednesday.*

*Forum Delegates may choose to attend any of the concurrent presentations in Design, Curriculum & Collaboration, Engineering or Manufacturing.*
Forum Agenda “At-a-Glance”

Wednesday, July 29 – PACE Global Annual Forum (continued)

<table>
<thead>
<tr>
<th>2:00 – 3:25</th>
<th>Technical Session Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session</strong></td>
<td><strong>Industrial Design</strong></td>
</tr>
<tr>
<td>Session Chair</td>
<td>Brigid O’Kane</td>
</tr>
<tr>
<td>University of Cincinnati</td>
<td>Michigan State University, retired</td>
</tr>
<tr>
<td>2:00 – 2:25</td>
<td>An Exploration of the Future Form of the Automated Car</td>
</tr>
<tr>
<td>Selby Coxon</td>
<td>Xiaobo Peng</td>
</tr>
<tr>
<td>Monash University</td>
<td>Prairie View A&amp;M University</td>
</tr>
<tr>
<td>2:30 – 2:55</td>
<td>Integrated Package Design: An Interdisciplinary Approach to Package Design that Benefits Consumer-Experience and Brand Perception</td>
</tr>
<tr>
<td>Todd Timney</td>
<td>Sergio Romero</td>
</tr>
<tr>
<td>University of Cincinnati</td>
<td>Hernandez</td>
</tr>
<tr>
<td>Dr. N Rajesh</td>
<td>Nathan Hartman &amp; Shawn Ruemler</td>
</tr>
<tr>
<td>Mathivanan</td>
<td>Purdue University</td>
</tr>
<tr>
<td>PES University</td>
<td></td>
</tr>
<tr>
<td>3:30 – 3:55</td>
<td>The Innovation of All-Terrain Resource Exploration Vehicle</td>
</tr>
<tr>
<td>Chuanyang Yu</td>
<td>Eduardo Toledo</td>
</tr>
<tr>
<td>Jilin University</td>
<td>Santos &amp; Fabiano</td>
</tr>
<tr>
<td></td>
<td>Rogerio Correa</td>
</tr>
<tr>
<td>University of São Paulo</td>
<td></td>
</tr>
<tr>
<td>4:00 – 4:30</td>
<td>Afternoon Break</td>
</tr>
<tr>
<td>4:30 – 5:00</td>
<td>Eco-Design - Approach to Sustainability for Year 2 of RSMS Project</td>
</tr>
<tr>
<td>Mo Omari, Global Manufacturing Engineering – ME Functional Lead</td>
<td></td>
</tr>
<tr>
<td>5:00 – 6:00</td>
<td>PLM / CAD Education Best Practices Panel Discussion</td>
</tr>
<tr>
<td>Moderated by: Bob Chalou</td>
<td></td>
</tr>
<tr>
<td>Panelists from select PACE institutions &amp; Siemens PLM Software</td>
<td></td>
</tr>
<tr>
<td>6:20</td>
<td>Busses depart for travel to hotels</td>
</tr>
<tr>
<td>Delegates are “on your own” for dinner this evening</td>
<td></td>
</tr>
</tbody>
</table>
## Forum Agenda “At-a-Glance”

### Thursday, July 30 – PACE Global Annual Forum

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 – 10:10</td>
<td>Welcome and Announcements</td>
</tr>
</tbody>
</table>
| 10:10 – 10:30 | What’s New in PACE  
*Vass Theodoracatos*, Manager, Global PACE Partnerships, GM |
| 10:30 – 11:10 | PACE Projects and the Impact on Careers  
Panel Discussion with former PACE project students and industry representatives on the impact of PACE projects on student education and career opportunities.  
**Moderator:** Stacy Benjamin, Director, Segal Design Institute, Northwestern University |
| 11:10 – 11:30 | Morning Break  
*Delegates move to “breakout” rooms for Technical Presentations* |
| 11:30 – 12:25 | Technical Session Presentations  
*Located in breakout rooms. Please refer to detailed agenda for abstracts* |
| 12:30 – 1:30  | Lunch – Outside Auditorium, Box Lunch                                                     |
| 12:00 Noon    | Poster Authors – Please pick up your posters from the display area.  
*Authors are responsible to retrieve their posters* |

### Morning

<table>
<thead>
<tr>
<th>Session</th>
<th>Curriculum &amp; Collaboration</th>
<th>Engineering</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session Chair</td>
<td>Bob Chalou</td>
<td>Jeff Morris</td>
<td>Sam Anand</td>
</tr>
<tr>
<td></td>
<td>Michigan State University,</td>
<td>Rensselaer Polytechnic</td>
<td>University of Cincinnati</td>
</tr>
<tr>
<td></td>
<td>retired</td>
<td>University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marcelo Augusto Leal Alves &amp; Antônio Campos Mariani University of São Paulo</td>
<td>Sam Anand University of Cincinnati</td>
<td>Virgilio Vásquez López &amp; Hector Rafael Morano Okuno ITESM - CEM</td>
</tr>
</tbody>
</table>
| 12:00 – 12:25               | Wind Tunnel Testing of an SAE Aerodesign Aircraft  
Enteroado Tadashi Katsuno & André Martins Campões University of São Paulo | Automated Modeling and Simulation of a Factory with 3D Visualization using Tecnomatix Plant Simulation  
Seohyeon Park & Suk Ho Chun Sungkyunkwan University |                                             |
**Forum Agenda “At-a-Glance”**

**Thursday, July 30 – PACE Global Annual Forum**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30 – 2:30</td>
<td><strong>Two concurrent sessions</strong> are offered at this time. Delegates may attend either session.</td>
</tr>
<tr>
<td>1:30 – 2:30</td>
<td><strong>Workshop: Hitting the Target – Did you meet your customer’s needs?</strong></td>
</tr>
<tr>
<td></td>
<td>Louise Stauffer, Sr. Staff Engineer, eXperience Innovation Architect, GM</td>
</tr>
<tr>
<td></td>
<td>Location: To be announced</td>
</tr>
<tr>
<td>1:30 – 2:30</td>
<td><strong>What’s New in NX</strong></td>
</tr>
<tr>
<td></td>
<td>John Baker, P.E., Product Evangelist, Product Engineering Software, Siemens PLM Software</td>
</tr>
<tr>
<td></td>
<td>Location: Auditorium</td>
</tr>
<tr>
<td>2:30 – 3:00</td>
<td><strong>Cultivating a Shared Vision with Interdisciplinary Teams</strong></td>
</tr>
<tr>
<td></td>
<td>Brigid O’Kane, Interim Director of the School of Design, University of Cincinnati</td>
</tr>
<tr>
<td>3:00</td>
<td><strong>Forum Adjourns</strong></td>
</tr>
<tr>
<td>3:10</td>
<td><strong>Board Busses for travel to hotels</strong></td>
</tr>
<tr>
<td>7:00 – 10:30</td>
<td><strong>PACE Forum Awards Celebration Dinner</strong></td>
</tr>
<tr>
<td></td>
<td><strong>VILLA Bisutti</strong></td>
</tr>
<tr>
<td></td>
<td>Rua Tenerife, 170 – Vila Olímpia, São Paulo</td>
</tr>
<tr>
<td></td>
<td>Hotel shuttles depart from each designated hotel at 5:30 PM</td>
</tr>
<tr>
<td></td>
<td>Dinner starts promptly at 7:00 PM (Dinner Ticket required for entry)</td>
</tr>
</tbody>
</table>
University of São Paulo Campus

Campus Venues

A – Auditorium B – Mechanical Engineering C – Civil Engineering
University of São Paulo Campus
Floor Plan of PACE Annual Forum Area

(See more detailed images on next pages)

- Conference sessions are in the José Augusto Martins Auditorium (yellow auditorium).
- Company displays and food service are located outside the auditorium entrance.
- Restrooms are located on the upper level (see next page).
Ground Floor Diagram: Monteiro de Camargo Building

The shuttles will stop at Luciano Gualberto Avernue (at the top of this diagram). Follow the pedestrian walkways to enter the building. Posters will be displayed on the upper level, use the stairs in the atrium.

Upper Floor Diagram: Monteiro de Camargo Building

Seating area, restrooms and access to the round classroom building where the technical sessions will take place are on this level.
The RSMS Team Meetings (Tuesday) and the Technical Session Presentations (Wednesday and Thursday) will be held in this building.

Access to this building can be found in the upper level of the Monteiro de Camargo Building.
In a world of smart products, where markets vanish in a single innovation, how do you compete? Traditional measures of success—quality, cost, speed—aren’t enough. It’s time to go beyond best practices...to next practices. Forward-thinking companies are “digitalizing” their entire innovation process, from development through production to utilization. Because having a great idea isn’t as important as realizing it.

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### Detailed Forum Agenda

**MONDAY JULY 27, 2015: PACE RSMS Project Competition Day**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td><strong>Conference Check-In &amp; Information</strong></td>
</tr>
<tr>
<td></td>
<td>J.O. Monteiro de Camargo Building (known as Biênio)</td>
</tr>
<tr>
<td></td>
<td>Av. Prof. Almeida Prado, travessa 2, nº 158</td>
</tr>
<tr>
<td></td>
<td>Cidade Universitária – Butantã - São Paulo – SP, 05508-010</td>
</tr>
<tr>
<td></td>
<td><em>University of São Paulo</em></td>
</tr>
<tr>
<td>All Day</td>
<td><strong>PACE Company Display Expo</strong></td>
</tr>
<tr>
<td></td>
<td><em>Open area outside the Auditorium</em></td>
</tr>
<tr>
<td>Morning</td>
<td><strong>Poster Authors</strong> – Posters are due this morning** at the information table.</td>
</tr>
<tr>
<td></td>
<td><strong>2015 PACE Global Annual Forum Opening Session</strong></td>
</tr>
<tr>
<td></td>
<td><em>Jose Augusto Martins Auditorium</em></td>
</tr>
<tr>
<td></td>
<td><em>J.O. Monteiro de Camargo Building (Biênio)</em></td>
</tr>
<tr>
<td></td>
<td><em>University of São Paulo</em></td>
</tr>
<tr>
<td>10:00</td>
<td>Welcome and Announcements</td>
</tr>
<tr>
<td>10:05</td>
<td>Welcome Remarks from PACE</td>
</tr>
<tr>
<td></td>
<td><strong>Vass Theodoracatos</strong>, Manager, Global PACE Partnerships, GM</td>
</tr>
<tr>
<td>10:10</td>
<td>Welcome Remarks from University of São Paulo</td>
</tr>
<tr>
<td></td>
<td><strong>Professor José Roberto Castilho Piqueira</strong>, Dean of Engineering, University of São Paulo</td>
</tr>
<tr>
<td>10:25</td>
<td>Welcome Remarks from General Motors Brazil</td>
</tr>
<tr>
<td></td>
<td><strong>William Bertagni</strong>, GMSA PE Vice President, South America Engineering, General Motors</td>
</tr>
</tbody>
</table>
**Reconfigurable Shared-Use Mobility Systems (RSMS)
Global Project Competition - Presentations & Judging**

The RSMS challenge involves a system of “building block” components that can be efficiently reconfigured for a variety of passenger vehicle and cargo delivery needs. Eight (8) integrated multi-national, multi-university teams from 45 PACE institutions will complete in this first phase of the competition. Each team will be judged on how well they understand the social, economic and convenience issues of their chosen market and how well their proposed mobility solution(s) addresses those issues. The RSMS teams, will report on their year-long efforts during today’s RSMS Competition Judging.

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:40</td>
<td><strong>RSMS Project Introduction</strong></td>
</tr>
<tr>
<td></td>
<td>Mo Omari, Global Manufacturing Engineering – ME Functional Lead</td>
</tr>
<tr>
<td>10:50</td>
<td><strong>RSMS Team Project Presentation – Team A</strong></td>
</tr>
<tr>
<td>11:25</td>
<td><strong>Morning Break</strong> – Area outside Auditório Vermelho - Biênio</td>
</tr>
<tr>
<td>11:45</td>
<td><strong>RSMS Team Project Presentation – Team B</strong></td>
</tr>
<tr>
<td>12:25</td>
<td><strong>RSMS Team Project Presentation – Team C</strong></td>
</tr>
<tr>
<td>1:00</td>
<td><strong>Lunch</strong> – Outside Auditorium, Box Lunch</td>
</tr>
<tr>
<td>2:00</td>
<td><strong>Opening Keynote Speaker:</strong></td>
</tr>
<tr>
<td></td>
<td>Rethinking Mobility: Driving the Future</td>
</tr>
<tr>
<td></td>
<td>Ken Kelzer, Vice President Global Vehicle Components and Subsystems, General Motors</td>
</tr>
<tr>
<td>2:40</td>
<td><strong>RSMS Team Project Presentation – Team D</strong></td>
</tr>
<tr>
<td>3:20</td>
<td><strong>RSMS Team Project Presentation – Team E</strong></td>
</tr>
<tr>
<td>3:55</td>
<td><strong>Afternoon Break</strong> – Area outside Auditório Vermelho - Biênio</td>
</tr>
<tr>
<td>4:20</td>
<td><strong>RSMS Team Project Presentation – Team F</strong></td>
</tr>
<tr>
<td>5:00</td>
<td><strong>RSMS Team Project Presentation – Team G</strong></td>
</tr>
<tr>
<td>5:40</td>
<td><strong>RSMS Team Project Presentation – Team H</strong></td>
</tr>
<tr>
<td>6:10</td>
<td><strong>Closing Remarks</strong></td>
</tr>
<tr>
<td>6:20</td>
<td><strong>Busses depart</strong> for travel to hotels</td>
</tr>
</tbody>
</table>

Delegates are “on your own” for dinner this evening
TUESDAY JULY 28, 2015:  PACE RSMS Project Competition & Judging Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td>Conference Check-In &amp; Information</td>
</tr>
<tr>
<td></td>
<td>PACE Poster Display</td>
</tr>
<tr>
<td></td>
<td>PACE Company Display Expo</td>
</tr>
<tr>
<td>10:00 – 10:10</td>
<td>Welcome and Announcements</td>
</tr>
<tr>
<td>10:10 – 10:40</td>
<td>Connected Mobility that Enhances and Promotes a Sustainable World</td>
</tr>
<tr>
<td></td>
<td>Clay Dean, Director, Global Advanced Design, General Motors</td>
</tr>
<tr>
<td>10:40 – 10:55</td>
<td>Morning Break</td>
</tr>
<tr>
<td>10:55 – 1:00</td>
<td>RSMS Design Review – Team Presentations</td>
</tr>
<tr>
<td></td>
<td>Each team will have 10 minutes to present the development of their design concept.</td>
</tr>
<tr>
<td>10:55 – 11:05</td>
<td>Introduction</td>
</tr>
<tr>
<td>11:10 – 11:20</td>
<td>RSMS Design Review Presentation – Team A</td>
</tr>
<tr>
<td>11:25 – 11:35</td>
<td>RSMS Design Review Presentation – Team B</td>
</tr>
<tr>
<td>11:40 – 11:50</td>
<td>RSMS Design Review Presentation – Team C</td>
</tr>
<tr>
<td>11:55 – 12:05</td>
<td>RSMS Design Review Presentation – Team D</td>
</tr>
<tr>
<td>12:10 – 12:20</td>
<td>RSMS Design Review Presentation – Team E</td>
</tr>
<tr>
<td>12:25 – 12:35</td>
<td>RSMS Design Review Presentation – Team F</td>
</tr>
<tr>
<td>12:40 – 12:50</td>
<td>RSMS Design Review Presentation – Team G</td>
</tr>
<tr>
<td>12:55 – 1:05</td>
<td>RSMS Design Review Presentation – Team H</td>
</tr>
<tr>
<td>1:05 – 2:00</td>
<td>Lunch</td>
</tr>
</tbody>
</table>
**Parallel activities** are scheduled for Tuesday afternoon from 2:00 – 6:00 pm.  
For all Forum Delegates, you may choose to:

- Visit the Company Display Expo and meet with PACE company representatives outside the Jose Augusto Martins Auditorium. Companies include: Autodesk, CD-adapco, Oracle, Siemens PLM Software, Synopsis
- Company Office Hours - Attend a session with PACE Forum Diamond and Gold Sponsors
- Tour University of São Paulo laboratories, meet at the Information Table
- View the posters
- RSMS Team Members, see below

**For All RSMS Team Members:**
RSMS Teams and Judges meet for Q&A sessions in the Central Room at Cirquinho (round classroom building).

Teams waiting for their meeting time may visit the Company Display Expo located in the open area outside Jose Augusto Martins Auditorium.

10 minutes prior to RSMS Team Meeting session, teams should gather in the designated area outside the Cirquinho Central Room.

Team meeting times are listed below.

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30 – 2:00</td>
<td>RSMS Team Q&amp;A Session with Judges – Team A</td>
</tr>
<tr>
<td>2:00 – 2:30</td>
<td>RSMS Team Q&amp;A Session with Judges – Team B</td>
</tr>
<tr>
<td>2:30 – 3:00</td>
<td>RSMS Team Q&amp;A Session with Judges – Team C</td>
</tr>
<tr>
<td>3:00 – 3:30</td>
<td>RSMS Team Q&amp;A Session with Judges – Team D</td>
</tr>
<tr>
<td>3:30 – 4:00</td>
<td>RSMS Team Q&amp;A Session with Judges – Team E</td>
</tr>
</tbody>
</table>

**Afternoon Break**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00 – 5:00</td>
<td>RSMS Team Q&amp;A Session with Judges – Team F</td>
</tr>
<tr>
<td>5:00 – 5:30</td>
<td>RSMS Team Q&amp;A Session with Judges – Team G</td>
</tr>
<tr>
<td>5:30 – 6:00</td>
<td>RSMS Team Q&amp;A Session with Judges – Team H</td>
</tr>
</tbody>
</table>

**RSMS Judges Wrap-Up**

**Busses depart** for travel to hotels

Delegates are “on your own” for dinner this evening
WEDNESDAY JULY 29, 2015: Innovation Day

All Day
Conference Check-In & Information

All Day
PACE Poster Display

All Day
PACE Company Display Expo

10:00
Welcome and Announcements

10:10
NX User Experience
Danny Sicking, Manager – NX UI Tools and Core Architecture, Product Engineering, Siemens PLM Software

10:50
Design for Six Sigma Methodology
Dhana Radhakrishnan, Manager, GM Tech Center India Engineering, GM

11:30 – 11:50
Morning Break

11:50 – 1:00
2015 PACE Collaboration and Innovation Challenge (CIC) Project Competition Finalists Presentations

Project Coordinator: Dr. Delia J. Valles-Rosales, Associate Professor, New Mexico State University

CIC Finalists:

- "Designing, Modeling and Analysis of iREACTOR (Innovation Regenerative Electromagnetic Air Compressed Cogenerative Tesla Optimized Rotor Engine),” Sri Jayachamarajendra College of Engineering, Mysore, India
- "Industrial design, engineering, and manufacturing development of an individual mobility solution for the future: Mobit," ITESM-Estado de Mexico & Politecnico di Torino
- “Passenger Car with Easy Access,” Kookmin University (Automotive Engineering and Automobile and IT Conservance) Team C
- “Reconfigurable Vehicle for seniors, handicaps, and all of us with strong emphasis on shared use concept,” Kookmin University, Team B
- “Modular Urban Driving System with Docking Mechanism (MUDS with Dock),” Kookmin University
- “Designing, Modeling and Analysis of CO-MAG-IC,” Sri Jayachamarajendra College of Engineering, Mysore, India
Parallel technical presentations are scheduled after lunch on Wednesday.

Forum Delegates may choose to attend any of the concurrent presentations in Design, Curriculum & Collaboration, Engineering or Manufacturing.

2:00 – 2:25  **Technical Session Presentations**

2:00 – 2:25  **Industrial Design Track:**

“An Exploration of the Future Form of the Automated Car”

**Presenter:** Selby Coxon, University of Cincinnati

**Location:** A1-05

This paper concerns an examination of the future of the automated car as it pertains to its future form language. The history of the private car is predicated upon its evolution from a horse drawn carriage. A form relationship between the location of the power source, the driver command and control through to passenger and cargo accommodation continues as part of the contemporary visual language of automotive design.

The advent of automated vehicles in which the driver abdicates responsibility for the immediate driving of a vehicle, along with advances in powertrain technology, presents an opportunity to question the visual orthodoxy of automotive design.

Driverless vehicles are common in the public transport and industrial domains. However, the migration of autonomous and semi-autonomous cars into the private sector is only just emerging; where the freedom and enjoyment of driving once dominated. This advance in transport technology re-negotiates the relationship of trust between passenger and the machine; a phenomenon which invites investigation into how trust can be construed in vehicle design. The pleasure of driving is replaced by the social engagement of being a passenger. Active participation replaces the fatigue of concentration and the chore of navigation. The private car is becoming part of the digital tableau. With no driving skill required, mobility access increases, potentially expanding society’s fleet to children and the elderly alike. The literature indicates that shared automated mobility significantly reduces the costs of transport to the individual in the reduction of parking and time not driving.

Through an examination of the visual language of the private car, this research identifies that the emotive qualities of transport will be an important factor in the evolution of autonomous vehicles. The research also indicates that pro-active work may be necessary to realise the benefits of autonomous private vehicles as part of the public transport system.

2:00 – 2:25  **Curriculum & Collaboration Track:**

“Integrating Student-Made Screencasts into Computer-Aided Design Education”

**Presenter:** Xiaobo Peng., Prairie View A&M University

**Location:** A1-06

Screencast tutorials have been widely used in the computer-aided design (CAD) education. With the aid of the digitally recorded videos presenting the modeling procedures visually, students can learn modern three-dimensional (3D) modeling software efficiently. Screencast serves as an efficient education tool, which can be integrated into the traditional face-to-face classroom. However, in current CAD education, screencasts are often created by instructors, and provided to students after class. Students watch the sceencasts and learn the software by following the modeling procedures. This conventional use of screencasts in learning has some deficiencies. The students are mostly kept in a passive role in the learning process, since they do not participate in designing the learning material. Therefore, this is regarded as a “passive learning environment”.

This paper presents the work of creating an “active learning environment” for the learning of NX software, in which students make screencasts on CAD modeling problems and share with others. Following an experimental study design, students were grouped into control section and experimental section. In the control section, students received the traditional instructor-centered instruction. In the experimental section, students were divided into small groups, in which they designed their own screencasts and provided comments to others’ screencasts. The students’ learning outcomes were evaluated, such as life-long learning skill, engineering altitude, and CAD modeling skills using NX. Three instruments, including life-long learning skill survey, engineering altitude survey, and CAD modeling exam, were used to evaluate students’ learning outcomes. An exit project survey was used to collect students’ feedback on this project.
2:00 – 2:25

**Engineering Track:**

“Reconfigurable Power Sources for RSMS Vehicles”

Presenter: Vikas Chayal & Sandesh Nayak, PES University

Location: A1-04

The presentation will encompass the following topics:

1. Selection of a battery of appropriate capacity keeping in mind economy, charging speed, ease of charging, weight, size, efficiency.
2. Exploring various modes of configurability for urban, sub-urban, rural scenarios.
3. Shortlisting a suitable mode that is economical, easy to re-configure, versatile.
4. Making use of PACE Software to design and implement the system in the RSMS vehicles.
5. Testing the feasibility of such a system in real world conditions.

2:00 – 2:25

**Manufacturing Track:**

“Formal Ontology and Integration Framework for Product Modeling”

Presenter: Kyoung-Yun Kim, Wayne State University

Location: A1-03

This work presents an ontological product modeling by integrating spatiotemporal-mereotopological formal ontology and CAD systems. This presentation discusses current design knowledge management and formal ontology research works and presents an integration framework that can incorporate design knowledge within CAD systems through the formal ontology. The primary role of spatiotemporal mereotopology in this research is the formal representation of design knowledge to support dynamic modeling for the complex product models. Existing research works about design ontology present an abstract form and often requires significant efforts to be integrated into CAD systems. Thus, this work discusses the practical use of a formal ontology as an alternative way to integrate design knowledge with CAD systems. For the implementation, a macro-parametric approach for CAD systems, Protégé, SPARQL, and NX CAD system are employed. Finally we discuss the use of the integration framework for product modeling research and education.

2:25 – 2:30

Break between presentations – Time allowed for moving to next session.

2:30 – 2:55

**Technical Session Presentations**

2:30 – 2:55

**Industrial Design Track:**

“Integrated Package Design: An Interdisciplinary Approach to Package Design that Benefits Consumer-Experience and Brand Perception”

Presenter: Todd Timney, University of Cincinnati

Location: A1-05

It is perplexing that Package Design has traditionally been taught as a course isolated in either Graphic or Industrial Design programs. To develop a truly unified brand narrative, package design necessitates an interdisciplinary, human-centered, and collaborative approach, which expands on the knowledge of each discipline and reaches into other areas of expertise.

In a recently concluded studio course, 30 undergraduate design students from Graphic Communication Design and Industrial Design worked in interdisciplinary teams across 15 weeks on these complex issues to create successfully integrated package concepts. The experience challenged students and professors to negotiate the intersection between disciplines while clarifying their own areas of expertise. Industrial Design students applied their knowhow of materiality and form development using Autodesk Alias software to support the structural packaging dimension of the studio, while Graphic Communication Design students shared their informed perspective on brand messaging and 2-dimensional communication.
2:30 – 2:55  
**Curriculum & Collaboration Track:**

“A New Structure for PACE Projects, Better Results Based on Student Skills and Course-Linked Objectives”

Presenter: Sergio Romero Hernandez, Instituto Tecnologico Autonomo de Mexico (ITAM)

Location: A1-06

Traditionally, PACE projects have been following a structure where a small team of profiled students are assigned at least one mentor from GM and an academic advisor for a period of six months to produce an established outcome. However this structure presents some drawbacks that may compromise its effectiveness; oftentimes the objective and current situation have not been fully developed and may present a fuzzy front end, moreover, the project is an extracurricular activity so the composition of the team is based not on skills but on student interest. Additionally, they present an extra workload for the academic advisor with no direct incentive. Based on this awareness and working together with GM Mexico, we devised and test a new structure to overcome the drawbacks. A single project (conceptual design of infotainment systems for the Mexican market) was outlined for a whole class (20 students) in the Product Design and Development, PDD, course, the students were required to fill a team player survey to identify their style as team players either as contributor, collaborator, communicator or challenger. Five teams were arranged composed of a member of each style, so their current strengths could be maximized in benefit of the team. Four partial deliveries where established where the teams presented their work to a board of GM evaluators, received feedback and got a grade. A final presentation with the same structure was also performed at the end of the semester. The course followed a standard methodology of PDD as presented by the Ulrich textbook: establishment of the project goals and reach, definition of the market, identification of customer needs, and generation of technical specifications based on QFD techniques, generation of concepts, filtering and selection of the best concept to develop, establishment of product architecture and conceptual development of the selected concept. The results were extremely positive and even praised by the GM mentors, since the project was directly linked with the course grade the students had a positive incentive to perform, moreover, since there were five teams developing the same project the teams were faced with a positive competition that motivates them to improve their performance. Based on the results achieved we believe that this new structure for PACE projects is a significant improvement enforcing the collaboration between industry and academy in a more effective manner.

2:30 – 2:55  
**Engineering Track:**

“Development of Timing Chain Cam Drive with a Pre-loaded Steel Spring Blade Tensioner”

Presenter: Rajesh P.K. & Kishore R., PSG College of Technology

Location: A1-04

Automotive engines generally use timing belts or timing chains to transmit crankshaft rotation to the camshaft and accessories. A tensioner unit can act to keep the tension of the belt or chain constant, and has shown to be effective at improving chain life as well as reducing noise generation. Implementation of Tensioner will result in increase in cost of the system and the number of components. In order to overcome such drawbacks, A spring steel blade embedded in the tensioner arm will be pre-loaded serving the purpose of tensioner for a timing chain drive, where there is no requirement of external tensioner unit.

In this project, we use PACE tools such as Siemens NX for modeling the Timing chain drive and tensioner, Analysis part was done using ANSYS and Simulation on Noise using ACTRAN. Our results proved that pre-loaded steel spring blade could act as tensioner which offered to add constant tension and also have damping characteristics to allow for rapid tension changes. More over the cost of the system was almost less than half of the existing tensioner system.
2:30 – 2:55  **Manufacturing Track:**

“DFMA Analysis of a Carburetor Assembly – Case Study”

Presenter: Sujay Shidaganti & Akash Burman, PES University

Location: A1-03

A case study on carburetor is analyzed using Design for Manufacturing & Design for Assembly. Three different approaches are employed to analyze the product:- Boothroyd Dewhurst DFMA method, Hitachi assemblability evaluation method, Lucas DFMA technique.

2:55 – 3:00  **Break between presentations** – Time allowed for moving to next session.

3:00 – 3:25  **Technical Session Presentations**

3:00 – 3:25  **Industrial Design Track:**

“Conceptual Design of a Reconfigurable Utility Vehicle”

Presenter: Dr. N. Rajesh Mathivanan, PES University

Location: A1-05

The vehicles in the present scenario are usually designed to certain user condition, terrain, region and specific requirements. In today’s world it becomes difficult to accommodate more passengers in a vehicle than its capacity. In some situations, when there is only one passenger, but the goods to be carried are more, it again becomes a difficult situation. If the vehicle is designed to its fullest capacity, and has not be used fully, the volume of space it occupies on the road is unwanted. From the above problem, there is an urgent need to design and develop a vehicle that could be reconfigured as and when required by the passenger to serve his best use.

3:00 – 3:25  **Curriculum & Collaboration Track:**

“Supporting PACE Projects with Virtual PLM Architecture”

Presenter: Nathan Hartman & Shawn Ruemler, Purdue University

Location: A1-06

Companies often experience challenges with data sharing, collaboration, and PLM tool configuration when dealing with dispersed work teams. Historically, the PACE project teams have experiences similar challenges. While deploying and using the CAD tools (NX) for PACE projects is rather straightforward, using the product data and configuration management tools (TeamCenter) for these same projects is comparatively more difficult. As such, Purdue University’s PLM Center and the virtual product integration academic program have agreed to host the virtual computing architecture for the 2015 PACE project teams. All or portions of six PACE teams have agreed to participate in the pilot implementation. This presentation will provide motivation, background, and deployment details used for the pilot implementation. Lessons learned from the pilot will inform future decisions for supporting distributed PACE teams.
3:00 – 3:25  **Engineering Track:**

“Modeling and Dynamic Simulation on a Small 4WS Electric Car”
Presenter: Guoming Deng & Zihao Zheng, Tongji University
Location: A1-04

Aiming to develop a flexible car for women, who will become a big consumer group in the future, a small electric car is designed in a project of Tongji PACE. As a smart car matching the women’s conditions, it has a four wheel steering system (4WS) containing two working modes. Both a conventional steering system working mode and a servo-control steering system working mode are used in the small electric car, which is driven by four motors in wheel. The mechanical structure of the steering system is modelled by Siemens NX 8.5. Then, a dynamic simulation using MSC Adams is applied for both steering working modes and results are compared with a general front-wheels steering car in steady-state characteristic and transient characteristic of the vehicle handling. We can use the servo-control steering system to make the wheels be steered in an angle range from zero to 90 degrees. Thus, a control strategy is developed by Matlab to implement the functions. Through simulation utilizing Adams and Matlab softs, the flexibility and handling stability of the small 4WS car is demonstrated well and the simulation results can be used for mechanical and electrical improvement.

3:00 – 3:25  **Manufacturing Track:**

“Gears by Powder Metallurgy for Baja SAE Vehicle: Design, Manufacturing and Evaluation”
Presenter: Mário D’Alessandro Neto, University of São Paulo
Location: A1-03

The process “powder metallurgy” has gained prominence with the rising pressure for cost reduction and environmental issues, due to its high material and energetic resources utilization. Even though it is already widely used, the challenge nowadays is to produce structural components with better proprieties. To achieve this objective, processes are being developed, such as HIP (Hot Isostatic Pressing) that results in the total densification of the material.

The object of study is the gear of the transmission a Baja SAE vehicle, this gear was remanufactured utilizing a blank made by HIP from the powder mix Astaloy™ 85 Mo + 0.28% C, the gear was originally designed to be manufactured from SAE 8620 steel, and an copy was made to serve as reference. The gears underwent hardness testing and teeth profile analysis after manufacturing. The gears were tested on a Baja SAE vehicle in an endurance test for 8 consecutive hours each without presenting failures or visible signs of fatigue. Metallographic analyses of the teeth were also made, which showed a martensitic structure with a high carbon content at the case in both, while, at the core, the sintered gear showed a martensitic structure with low carbon content.

3:25 – 3:30  **Break between presentations** – Time allowed for moving to next session.

3:30 – 3:55  **Technical Session Presentations**

3:30 – 3:55  **Industrial Design Track:**

“The Innovation of All-Terrain Resource Exploration Vehicle”
Presenter: Chuanyang Yu, Jilin University
Location: A1-05

Research shows, there are still large quantities of resources on the earth that we have not found yet. So resource exploration will play a more important role in the future. Our project team will focus on innovating the smart all-terrain resource exploration vehicle. We expect, the vehicle should have the following functions. First, it has special chassis so that it can run smoothly on some complex terrain including grass, snow, sand, etc. Secondly, it has some wireless connection modules so that it can be remoted from about 1 kilometer away. Thirdly, it equips with advanced resource exploring devices which can show the structure under the ground immediately after exploring. In order to achieve our expectations, we divided our team into several parts, each part deal with a certain module. The team leader is responsible for making timetables and inspecting the process. What's more, we cooperate with another program team from a geography institution from Jilin University. We hold a discussion each month.
3:30 – 3:55

**Curriculum & Collaboration Track:**

“From Conception and Design to Simulation and Manufacturing: PBL in an Engineering Freshman Course”

Presenter: Eduardo Toledo Santos & Fabiano Rogerio Correa, University of São Paulo

Location: A1-06

This presentation will describe how our Engineering Design Course was revamped to incorporate Project-Based Learning and Flipped-Classroom methodologies. Entering students develop a project from sketches to parametric modeling and assembly. Virtually test it using motion simulation and document it with multi-view and exploded view drawings. Finally, they build it using 3D printers and laser cutter, producing a working prototype.

3:30 – 3:55

**Engineering Track:**

“Making a Frequency Analysis of an Engine Mount by Means of CAE Software, as Well as Through an Experimental Test”

Presenter: Julian Maurico Echeverry Mejia & Virgilio Vasquez Lopez, ITESM - CEM

Location: A1-04

On the automotive industry, the engine mount is one of the most important components for the attenuation and control of the mechanical vibrations produced by the engine at different regimes of operation. Engine mounts properly locate the engine in the chassis, and are an important factor in how smoothly a vehicle operates. The mounts, as every part of the vehicle, has several natural frequencies which corresponds to different vibration modes. So, if the operational frequency of the engine is near, or equal to, a natural frequency of the mount, will transfer an amplified vibration of the engine to the chassis and all the vehicle.

With reference to the above mentioned, we decided to make a frequency analysis of a Chevrolet Silverado 1500 pick-up engine mount which is entirely made of steel and has some welded parts to it. The objective of this project was to develop a methodology for obtaining the natural frequencies of the engine mount by means of the finite element method using OptiStruct and LS-DYNA solvers, as well as through an experimental test.

The first step was to build up the CAD of the engine mount so we can introduce this geometry on the finite element package called Altair HyperWorks to do the mesh and obtain the natural frequencies for the first 5 modes of vibration of the Silverado’s engine mount using OptiStruct and LS-DYNA solvers. But before doing the analysis and as addition to our project, we characterized the welding first as rigid bodies, and secondly by beams of deformable material denoted as mat100 using LS-DYNA solver or as RBE3 using OptiStruct solver. This in order to observe how the way we characterize the engine mount impacts on the natural frequencies values, and to validate our results comparing them with the experimental test.

Subsequently, we made a simulation of the experimental test, which consists on setting up an accelerometer in the position of major displacement at vibrating, previously known at obtaining the natural frequencies, and finally we gave it a pulse by hitting the engine mount with a rubber hammer. The simulation of the experimental test was made by using an explicit LS-DYNA analysis, in order to obtain a guideline on how to perform the test so we could obtain better results at the moment of doing the experimental test.

Finally, after doing the experimental test, we made a Fourier analysis of the data obtained by the accelerometer in order to find all the different vibration modes and its natural frequencies, comparing this results with the obtained by the CAE analysis.
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<th>Time</th>
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</table>
| 3:30 – 3:55 | **Manufacturing Track:** “Feature Graph Based Design Validation for Manufacturability in Additive Processes”  
Presenter: Sam Anand, University of Cincinnati  
Location: **A1-03**  
Additive manufacturing technologies are used to fabricate complex 3D shapes using a layer by layer material deposition technique. This research focuses on bridging the gap between design and manufacturing by developing a CAD application tool which can validate designs based on AM manufacturability issues. Process includes formulation of design guidelines for additive manufacturing along with development of feature recognition algorithms for assisting designers in avoiding hard to manufacture designs. |
| 4:00 – 4:30 | **Afternoon Break**                                                  |
| 4:30 – 5:00 | **Eco-Design – Approach to Sustainability for Year 2 of the RSMS Project**  
Mo Omari, Global Manufacturing Engineering – ME Functional Lead  
General Motors |
| 5:00 – 6:00 | **PLM / CAD Education Best Practices Panel Discussion**  
Moderated by: Bob Chalou  
Panelists from select PACE institutions & Siemens PLM Software. |
| 6:20 | **Busses depart** for travel to hotels |
|        | **Delegates are “on your own” for dinner this evening** |
### THURSDAY JULY 30, 2015: Global Collaboration Day

<table>
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<tr>
<th>Morning</th>
<th>Conference Check-In and Information</th>
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<tr>
<td>Morning</td>
<td>PACE Poster Display</td>
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<tr>
<td></td>
<td>PACE Company Display Expo</td>
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</tbody>
</table>

#### 10:00 – 10:10
**Welcome and Announcements**

#### 10:10 – 10:30
**What’s New in PACE**

*Vass Theodoracatos,* Manager, Global PACE Partnerships, GM

#### 10:30 – 11:10
**PACE Project Impact**

Panel Discussion with former PACE project students and industry representatives on the impact of PACE projects on student education and career opportunities.

**Moderator:** Stacy Benjamin, Director, Segal Design Institute, Northwestern University

Participants in the room:
- Camila Souit, University of São Paulo
- Antonio Carlos Botosso, University of São Paulo
- Sheryl Garrett, Manager, Global Creative Resources, GM
- Dora Smith, Siemens PLM Software

Other Participants to join via Video

#### 11:10 – 11:30
**Morning Break**

*Delegates move to “breakout” rooms for Technical Presentations*

#### 11:30 – 12:25
**Technical Session Presentations**

**Industrial Design Track:**

No Industrial Design Track presentations on Thursday
11:30 – 11:55 **Curriculum & Collaboration Track:**

**“Mentoring Extra Curricular Activities**

Presenter: Marcelo Augusto Leal Alves & Antônio Campos Mariani, University of São Paulo

Location: A1-06

Engineering Education based in project and prototype testing, in a multidisciplinary approach, is a strategy that has shown excellent results in different educational experiences, in several countries. Many Authors have presented several successful experiences in such activities. In Brazil, several positive experiments in many different areas of engineering have been promoted by technical societies such as the local chapter of SAE as well as by programs such as PACE.

The basic idea is to adopt a competition to form a multidisciplinary team of engineering students in order to develop and manufacture a vehicle that will compete with others made by similar teams from around the country. The rules, restrictions, limits to resources as well as other local boundary conditions serve as guidelines to motivate the students to develop their innovative prototypes. Breaking the limits of some technical area, discovering new materials combinations, performing tests and validating computer simulations and the developed theoretical models are among some of the activities performed by the students during the development cycle. Good team results have been noticed when some of the team members can fully develop their project in a specific area.

The project under mentoring are SAE Mini Baja, Formula Student, Aerodesign, Fuel Economy Challenge as well as Robot wars and the PACE Global Vehicle Project, Mentoring the students that are part of such projects is a challenge to both faculty and students. Some of the challenging aspects are the little importance given to such activities on faculty performance assessments. To the students the main difficulty is how to make the team competitive while there are other academic demands. At Escola Politecnica (USP) two classes were created not only to give academic recognition to both faculty and students but also as motivation to the students to further develop their projects under closer supervision of the advisor and also to develop other skills such as preparing oral presentations and being subject of intense questioning regarding their projects.

This paper presents some case studies, project mentoring experiences that helped the students to organize their tasks in a larger project.

11:30 – 11:55 **Engineering Track:**

**“Optimization of Part Quality with Minimal Support Structures in DMLM Process Using Siemens NX Modeler”**

Presenter: Sam Anand, University of Cincinnati

Location: A1-04

Additive Manufacturing (AM) is the process of building a part by adding layers of material on top of each other. Part build orientation is one of the crucial process parameters which affect part quality, mainly, Geometric Dimensioning & Tolerancing (GD&T) errors on the part and the extent of support structures required. An approach is suggested to identify an optimal build orientation which will minimize the volume of support structures while meeting the specified GD&T criteria of the part for a DMLS based process. Siemens PLM NX API is used to extract the GD&T callouts and associated geometric information of the CAD model which are later used in the optimization model. The regions requiring support structures are identified and a Quadtree decomposition is used to find the volume of support structures. The Quadtree is build using the surface points obtained from NURBS surface which in turn is obtained from the NX surface. A combined optimization model is then developed which will provide the optimal build orientation with minimized volume of support structures while meeting the GD&T criteria of the part.
### Manufacturing Track:

**“Robot Integration in a Manufacturing Cell Using Digital Manufacturing”**

Presenter: Virgilio Vásquez López & Hector Rafael Morano Okuno, ITESM - CEM  
**Location:** A1-03

This investigation project is oriented to explore the robots integration in a real manufacturing cell from its digital form using Tecnomatix PLM software from Siemens with its Process Simulate module. The importance of this project is increase and strength the knowledge about the PLM software use, for this case Tecnomatix – Process Simulate, integrating different technologies as CAD/CAE/CAM systems, automation and robotics with the objective of develop Digital Manufacturing Applications in academic and industrial level.  
The project originates from the need to optimize the implementation time of the integration of manufacturing cells projects. As background it is taken the project “Develop and implementation of virtual environments in an assembly cell”, which achieved migrate the control systems implemented in a virtual manufacturing cell in to a real environment to complement and achieve a greater reach in the subject matter.

### Break between presentations – Time allowed for moving to next session.

11:55 – 12:00

### Technical Session Presentations

12:00 – 12:25

#### Curriculum & Collaboration Track:

No Curriculum & Collaboration presentation scheduled in this time slot.

12:00 – 12:25

#### Engineering Track:

**“Wind Tunnel Testing of an SAE Aerodesign Aircraft”**  
Presenter: Eduardo Tadashi Katsuno & André Martins Camões  
**Location:** A1-04

This presentation details the experimental procedures and data obtained in the wind tunnel testing of a SAE Aero Design prototype aircraft and compares the results with previous analysis with STAR-CCM+CFD software. Design possibilities from the data are also discussed.  
The use of experimental methods for aerodynamic analysis, despite the increasing development of computational fluid dynamics technology, remains the main source of information for the development of projects in various areas of engineering. For the aircraft participating on SAE Brazil Aerodesign competition, wind tunnel tests have an important role to aerodynamic analysis, collaborating to the project calculations and to the evaluation of design alternatives.

12:00 – 12:25

#### Manufacturing Track:

**“Automated Modeling and Simulation of a Factory with a 3D Visualization using Tecnomatix Plant Simulation”**  
Presenter: Seohyeon Park & Suk Ho Chun, Sungkyunkwan University  
**Location:** A1-03

Nowadays, Digital virtual manufacturing has been rapidly developed to apply itself to industry with a process. So far, multiple programs should be needed in order to analyze throughput, layout, material flow, etc. Automated three dimensional modeling and simulation on plant is introduced. This is implemented by just one engineering tool, Plant Simulation. In this way, all the manufacturing resources and processes are allocated base on plant’s layout data. Of course, it can perform analysis on manufacturing process in visual format in order to provide easy understanding. In just one tool, it can show three dimensional plant structure and manufacturing process.
12:30 – 1:30  Lunch

1:30 – 2:30  Two concurrent sessions are offered at this time. Delegates may choose to attend either session. Select from Hitting the Target Workshop and What’s New in NX. Details are provided below.

Option 1:  Workshop: Hitting the Target – Did you meet your customer’s needs?
Louise Stauffer, Sr. Staff Engineer, eXperience Innovation Architect, GM
Location: To be announced
Join us for an informative, interactive workshop to help your team prepare for the 2nd year of the RSMS competition. Topics will include: the importance of getting the target customer’s reaction to your concept, creating a customer feedback plan, and how to make sure what you hear is really what they mean!

Option 2:  What’s New in NX
John Baker P.E., Product Evangelist, Product Engineering Software, Siemens PLM Software
Location: Auditorium
The ‘What’s New in NX’ presentation, which will be almost entirely a live demonstration of the software itself, will cover the latest enhancements to the basic core capabilities of NX, including User Interface, Part and Assembly Modeling, Drafting and other topics of general interest for people currently utilizing NX in their classrooms and/or student projects. The scope of the material covered will include NX 10.0.2.6 as well as an early look at some of the improvements being planned for NX 11.0.

2:30 – 3:00  Cultivating a Shared Vision with Interdisciplinary Teams
Brigid O’Kane, Interim Director of the School of Design, University of Cincinnati

3:00  PACE Forum Adjourns

3:10  Board Busses for travel to hotels

7:00 – 10:30  PACE Forum Awards Celebration Dinner
VILLA Bisutti
Hotel shuttles will depart at 5:30 PM from the designated PACE hotels
Dinner starts promptly at 7:00 PM. (Dinner Ticket required for entry)
Poster Session

The posters that were submitted for the PACE Poster Session will be displayed in the Atrium area during the conference.

22 posters were submitted for this year's Forum Poster Session. The posters are displayed on the following pages.
Poster Submission

ID # 2: “SENER (Development of a Hybrid Utilitarian Vehicle”
ITESM Toluca

SENER is a fuel cell technology vehicle designed for research purposes; the fuel cell is a green technology with zero emissions, through this project we were able to establish the technical benefits and limitations of this technology.
Poster Submission

ID # 21: “Design and Analysis of a Reconfigurable Shared-Use Mobility System for Urban Commuters”
Tuskegee University
Poster Submission

ID # 31: “DFA Analysis based on Automated DPA using Siemens NX”
SungKyunKwan University

Design For Assembly Analysis by Automated Digital Pre-Assembly using NX

Koem Son  Jooetek Cho  Sang Do Noh
Department of Mechanical Engineering, SungKyunKwan University

Introduction
- Manufacturers have been producing various products to respond to the rapidly changing needs of the market and customers.
- Geometries and overall performances of products are significantly different from the product development phase to the production phase.
- DFA is a systematic way to improve the product development process.

DFA/Digital Pre-Assembly
- DFA is a systematic way to improve the product development process.
- DFA is used in the product development phase.
- DFA can reduce manufacturing process costs in automotive and aerospace industries.

DFA (Design For Assembly)
- DFA is a design method that enables easier and more economical production of parts.
- DFA reduces the assembly costs of parts by simplifying the product design.

DPA (Digital Pre-Assembly)
- DPA is a process of simulating the assemblyability of parts through 3D modeling.
- DPA can be used in the pre-assembly phase and design phase.
- DPA can solve potential manufacturing problems in automotive and aerospace industries.

Data Recognition Method
- DFA index was calculated by automated DPA using Siemens NX model.
- The data includes parametric parts and DFA indices.

Application and Results
- The DFA index was calculated by automated DPA using Siemens NX model.
- The results show that parametric parts and DFA indices are reduced.

Conclusion / Future study
- A new DFA method that reduces the time and effort required for development.
- This method can produce more intuitive and effective results than those of the traditional method through automated DPA using Siemens NX model.
- The method allows users to automatically assess the feasibility of a model through 3D modeling.
- It is expected that the applicable DPA indices can be continuously expanded.
- Future studies will enable the retrieval of additional information through a diverse user interface or in other file formats.

ACKNOWLEDGEMENT
This work was supported by Technology Innovation Program (1004601), Development of Manufacturing Service Platform Based on Knowledge Intensive Digital Model funded by the Ministry of Industry, Culture & Tourism (MI, Korea).

REFERENCES
Poster Submission

ID # 35: “WP-Concept: new energy, smart, microcar”
Wuhan University of Technology
Poster Submission

ID # 37: “Unicycle with Variable Radius”
Wuhan University of Technology

**ELECTRIC UNICYCLE**

**BACKGROUND**

By 2050, urban areas will be the home for more than 66% of the world’s 8 billion people. This will create tremendous pressures in the form of pollution, congestion, energy security and traffic safety. This car is to challenge a public infrastructure that is already struggling to meet the growing demand for transportation and basic services.

**THE TARGET MARKET GROUP**

Alarmed at young people such as:
White-collar work, teachers, college students and sports enthusiasts

**MEANING OF MODELLING**

The modelling design of car body is derived from the tail, making the whole modelling with clever and vitality. The red color is more fit to show the youth’s bold, passion and personality.

**FUNCTIONAL INTEGRATION**

Electric unicycle is mainly used for the short driving while non-motor vehicle road driving, it is small, light and easy to operate. Besides, it can be controlled by body feeling and implement functional integration by splitting plucking.
Poster Submission

ID # 43: “Mass Customization in Product Lifecycle Management environment based on Additive Manufacturing”
University of São Paulo

Mass Customization in Product Lifecycle Management environment based on Additive Manufacturing

Samantha Yang, Ednardo de Senz Zancul, Gabriel Deiga e Silva
University of São Paulo – ezancul@usp.br

Abstract

Product Lifecycle Management (PLM) and Mass Customization have been both consolidating as strategic approaches to increase companies’ competitiveness. The first supports companies by improving their portfolios with a number of product variants, the second has been recognized as a manufacturing strategy that guarantees, through product platform and modularized product strategy, product customization while aiming not to lose production efficiency. Although current mass customization implementations bring volume and results, it demands increasing flexibility in the production, which is challenging to achieve. Recently, due to technology advances, additive manufacturing has been emerging as a promising manufacturing process with higher flexibility for lower volumes. With additive manufacturing, individualization degree could be extended to a higher level, including geometric adaptation for each customer, thus increasing the degree of freedom for product individualization to include changes in product design. The aim of this research is to discuss the application of additive manufacturing to support mass customization. A practical scenario based on a highly customized assistive technology product has been structured and implemented to simulate a real process and provide the data for the research. The scenario follows a set of activities, starting by the individual product modeling based on measurable customer parameters until its real production and delivery. Data generated along the scenario has been mapped considering a PLM approach for data management. The analysis of the scenario simulation provides insights and guidelines for industrial applications and future researches.

Concept

<table>
<thead>
<tr>
<th>Lifecycle phases and customization points</th>
<th>Design</th>
<th>Manufacturing</th>
<th>Assembly</th>
<th>Distribution</th>
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</thead>
<tbody>
<tr>
<td>Pure Customization</td>
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<td>Tailored Customization</td>
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<td>Pure Standardization</td>
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Customization point

Scenario

Product concept and design
Manufacturing
Assembly

References
Poster Submission

ID # 45: “Designing, Analysis and Experimental Investigation of Electromagnetic Internal Combustion Hybrid Engine (CO-MAG-IC)”

Sri Jayachamarajendra College of Engineering

INTRODUCTION

This poster presents the outcome of innovative and creative research carried out regarding designing, fabricating and evaluating a hybrid engine working on Electromagnets, Compressed air and the conventional energy from two Gasoline, these tests have been fulfilled using Solid Works, ANSYS, PFC, Solid Works, MATLAB and LabVIEW. The conventional four-stroke associated with ICE Engines are modified into six strokes, Energy saving, regeneration and co-generation parameters are illustrated.

OBJECTIVES

- The design and analysis of Electromagnetic Pressure energy of Compressed air with the help of Fuel, improving innovatively overall efficiency of the engine combustion.
- The design and alteration of the internal combustion engine for Electromagnetic component of CO-MAG-IC.

APPLICATION

CO-MAG-ICs used in small and medium size automobiles, commercial vehicles and industrial finals.

CONCLUSIONS

Prototype constructed has emphatically shown that it is possible to replace the conventional cycle to CO-MAG-IC cycle for the purpose of rectifying the issues identified for the study. Investigations have revealed that CO-MAG-IC has overall efficiency of 88% as compared with the conventional engines currently in use. Hydration of the engine has reduced the emission of Nitrogen Oxides (NOx) by 40%, Hydrocarbon (HC) and Carbon Monoxide (CO) by 50%. Since CO-MAG-IC has worked at 40 degree Celsius to 80 degree Celsius, power temperature from the conventional engine, there is a reduction in NOx emission.

INNOVATIVE IDEAS

- Merging three states of energy: Electromagnetic, pressure and Chemical energy.
- Electro-Magnatic of inlet and exhaust valves.
- Designing and controlling valves by potential switches.
- Creating three power strokes in three revolutions (two power strokes in the first two revolutions and one power stroke in the subsequent revolution).

WORKING PRINCIPLE

Four strokes of CO-MAG-IC are executed by Electromagnets and Compressed Air. Last two strokes are executed by Electromagnets. During the first stroke, Compressed Air enters the cylinder, fuel is injected and the stroke is given, both intake valves as well as outlet valves are closed. During the second stroke, Compressed Air enters the cylinder and the outlet valves are closed, and the intake valve is open. During the third stroke, combustion takes place in the cylinder, Compressed Air enters the cylinder and the outlet valves are closed and exhaust valve for combustion opens and air is released out of the engine. Extreme positions of the piston are sensed using the Reed Switch; the control system designed reverses the direction of current passing through the coil and triggers the magnetic poles.
Poster Submission

ID # 52: “Design of Student Innovation Carbon-free Energy-saving Car”
Hunan University
Poster Submission

ID # 53: “A Comparative FEM Analysis of Tribological and Strength Characteristics of Composites of PF and ER Matrices Reinforced with GF and other Filler Materials with Commercially Available Brake Pads”

Sri Jayachamarajendra College of Engineering

JSS Mahavidyapeetha
Sri Jayachamarajendra College of Engineering - Mysore
SJCE (an Autonomous Institution)
A Commitment to Technical Education

Presenters: K P SURAJ. VADRAJ R M N. MOHAN KUMAR
Supervisor: Dr. K Chandrashekar, Professor, Dept. of Mechanical Engineering, SJCE, Mysore

A COMPARATIVE FEM ANALYSIS OF TRIBOLOGICAL AND STRENGTH CHARACTERISTICS OF COMPOSITES OF PF AND ER MATRICES REINFORCED WITH GF AND OTHER FILLER MATERIALS WITH COMMERCIAL AVAILABLE BRAKE PADS

THE NEED
Use of composites has revolutionized automotive industries. Apart from their application in car bodies, composite materials play a pivotal role in the braking system of automobiles. Composite materials find their role in forming good automotive brake pads.

One of the major constituent materials of today’s brake pads is Asbestos. For many decades, asbestos has been used by the automotive industry in brake pads and linings, clutch facings, and gaskets. Millions of these products still remain on vehicles currently in use today, which pose severe health hazards. Asbestos, Lung cancer and Pleural Mesothelioma to auto mechanics and users across the globe.

WHAT WE HAVE DONE

Tribological properties and Compression Strength of Phenol Formaldehyde (PF) and Epoxy Resin (ER) Matrices reinforced with Glass Fiber (GF) and other filler materials (sens: Asbestos) with the Commercially Available Brake Materials (CAB1 and CAB2 with Asbestos) are experimentally determined.

Other constituent elements like Coconut Shell Powder (CSP), Alumina (Al2O3), Barium Sulphate (BS), Graphite and Antimony Sulphide (AS) were added to bring in other properties like wear resistance, thermal stability and strength. These PF (Asbestos) - GF and ER(GF) composites were subjected to Three Body Abrasion (TBA) and compression strength tests under varying sliding distance and loading conditions.

Values of wear loss, wear volume, specific wear rate and modulus were computed for the designed material and two commercially available brake pad materials. SEM micropgraphs for the fabricated materials and commercial materials are considered for the analysis and comparison. (SEM Micrographs)

WHAT WE HAVE ACHIEVED

FEM Analyses carried out using ANSYS 15P and SIEMENS UG NX 9.0 Advanced Simulation have shown that ER - GF composite material has significantly superior compressive strength in comparison with PF - GF and Commercially Available Brake Pad materials.

PF matrix composites (sens: Asbestos) have greater wear resistance (2.5%) and compressive strength (22.07%) in comparison with Commercially Available Brake pads; ER matrix composites (sens: Asbestos) have greater wear resistance (81.81%) and compressive strength (84.78%) in comparison with Commercially Available Brake pads.

It is emphatically concluded that, from both wear and strength considerations, ER matrix is the best composite for Friction Material applications.
Poster Submission


Sri Jayachamarajendra College of Engineering
Poster Submission

**ID # 56:** “Designing, Modeling and Analysis of iREACTOR – Innovative Regenerative Electromagnetic Air Compressed Cogenerative Tesla Optimized Rotor Engine”

Sri Jayachamarajendra College of Engineering

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**Introduction**

A Revolutionary, Green, Hybrid Tesla power-train is proposed as a mobility solution.

iREACTOR is a system of Compressed air and electromagnets driven by charged batteries located in the chassis, which are energized by Solar Photo Voltaic Cells and Micro Wind Turbines. Working principle of the engine, energy balance and other key details are also presented.

**Working Principle**

iREACTOR is a system where the air flows through unique electromagnetic engines, in reference to an air rotary engine through solenoid operated inlet valves and expands in the reciprocating space between the rotor and the casing. These Electromagnets are sequentially energized and demagnetized according to the speed of the rotor and get commanded by decay signals generated by a programmable logic controller. Further rotation of the rotor is by electromagnetic attractive force and the torque assistance is by the energy stored in the flywheel.

Various Energies Flow and their Balance and time required for Re-generation and the cycle of Input and Output Analysis.

**Results**

Results of iREACTOR Testing

<table>
<thead>
<tr>
<th>Percentage of full load vs. Overall Efficiency</th>
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<td>(created using Matlab)</td>
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**Highlights of the Project**

iREACTOR is a system where the air flows through unique electromagnetic engines, in reference to an air rotary engine through solenoid operated inlet valves and expands in the reciprocating space between the rotor and the casing. These Electromagnets are sequentially energized and demagnetized according to the speed of the rotor and get commanded by decay signals generated by a programmable logic controller. Further rotation of the rotor is by electromagnetic attractive force and the torque assistance is by the energy stored in the flywheel.

**Conclusions**

iREACTOR is a system where the air flows through unique electromagnetic engines, in reference to an air rotary engine through solenoid operated inlet valves and expands in the reciprocating space between the rotor and the casing. These Electromagnets are sequentially energized and demagnetized according to the speed of the rotor and get commanded by decay signals generated by a programmable logic controller. Further rotation of the rotor is by electromagnetic attractive force and the torque assistance is by the energy stored in the flywheel.
Poster Submission

ID # 60: “Conceptual Designs for Redefining Metropolitan Commuting”
Georgia Tech
Poster Submission

ID # 64: “CFD Simulation for Propeller”
Instituto Politécnico National

CFD Simulation for Propeller

Diego M. Almazo P.¹, Héctor R. Moramo O.², Carlos M. Rodriguez R.³, Miguel Toleda Y.⁴

¹LAMAY-CNPHP, ENE-IPN, Mexico City, Mexico ⁵IMSS-ENCA, Mexico City, Mexico ⁶IPN-Avanzada, Mexico City

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A Reynolds-Averaged Navier-Stokes (RANS) method has been employed in conjunction with an overlapping moving grid approach to provide accurate resolution of a five-blade propeller flows under both the design and off-design conditions. It is well known that some off-design propeller flow phenomena are dominated by viscous effects and cannot be accurately predicted by the potential flow methods. In order to properly account for viscous effects, it is necessary to employ accurate and robust numerical methods which can provide detailed resolution of the propeller boundary layer, turbulent wake, leading edge separation, and unsteady flow vortices induced by propeller operations under off-design conditions. In this study, time-domain simulations are performed for the NACA 6512 propeller.

Keywords: CFD, Propeller, design, RANS.

Methodology

Propellers can be represented with models of varying complexity. Broadly, the strategy of CFD is to replace the continuous problem domain with a discrete domain using a grid. In the continuous domain, each flow variable is defined at every point in the domain.

The following figure shows the grid used in the domain.

![Grid](image1)

Figure 1. The grid used in the domain.

Introduction

Applying the fundamental laws of thermodynamics to a fluid gives the governing equations for a fluid. The conservation of mass equation is:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{V}) = 0$$

and the conservation of momentum equation is:

$$\frac{\partial \rho \mathbf{V}}{\partial t} + \nabla \cdot (\rho \mathbf{V} \otimes \mathbf{V} + \mathbf{P}) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{F}$$

These equations along with the conservation of energy equation form a set of coupled, nonlinear partial differential equations. It is not possible to solve these equations analytically for most engineering problems. However, it is possible to obtain approximate computer-based solutions to the governing equations for a variety of engineering problems. This is the subject matter of Computational Fluid Dynamics (CFD).

![Grid](image2)

Figure 2. The grid used in the domain.

Figure 3. The results obtained on the seven grids with the exact solution.

Results

The figure 3 compares the results obtained on the seven grids with the exact solution. As expected, the numerical error decreases as the number of grid points is increased. When the numerical solutions obtained on different grids agree within a level of tolerance specified by the user, they are referred to as “grid converged” solutions.

![Grid](image3)
Virtual validation of measurement orders in automotive engineering

A. Faith M.Sc., S. Haug M.Sc., Prof. Dr.-Ing. R. Anfesel – TU Darmstadt, Department of Computer Integrated Design (DfK)

Motivation

Although continuous digitalization of processes offers large potential to improve interoperability and to ensure a defined level of quality, measuring services are still characterized by media discontinuities. To unlock this potential, real sensors and vehicle components are represented digitally based on the data format JT (ISO 14306:2012). The generated 3D models serve as basis for real sensor application and visualization of measuring results in reviews and collaboration.

Concept steps of virtual validation of measuring orders

1. Definition and display of coordinate values of sensor positions.
2. Assembly of sensor 3D models at their corresponding coordinate value.
3. Real sensor application based on virtual sensor vehicle model.
4. Display of measured results at corresponding sensor models and positions.

Defining measuring positions in the 3D model

Sensor positions are defined by selecting positions in the 3D model qualitatively.

The use of user defined coordinate values enables processing of measuring results and special interests in downstream processes quantitatively.

Coordinate values of defined sensor positions are displayed related to the 3D model.

Displaying Intersections

Intersections between sensor and vehicle components are displayed in the 3D model and can be corrected cost efficient in early phases of the measuring service process.

Transfer and testing of sensor positions

Precise coordinate transfer using 3D measuring machines (CMM). Measuring and validation of real sensor coordinate values and adjustment of sensor 3D models in the vehicle 3D model.
Poster Submission

ID # 88: “Modeling of a Suspension System and Baja SAE Vehicle with a Multibody Dynamics Software, including Study and Determination of the Dynamic Characteristics of a Tire”

Escola Politécnica da USP
Poster Session – July 28 - 30

The following posters were also submitted for the PACE Poster Session but did not submit images for the program book.

**ID # 23:** “Co-simulation of a Kind of AGV in Optimizing Automobile Production Line”
Tongji University

**ID # 67:** “Manufacturing Design of Low Cost CSA* Composites using Tecnomatix & Plant 3D”
Instituto Politécnico National

**ID # 68:** “Manufacturing and Operation Services for Reconfigurable Shared Mobility Systems”
Instituto Politécnico National

**ID # 72:** “Design of Multi-Tube Crash Energy Management System to Suit a Crash Pulse Requirement”
MSRUAS

**ID # 75:** “Applications for Multi Criteria Decision Making in New Product Development”
New Mexico State University

**ID # 77:** “Iterative Design and Rapid Prototyping”
New Mexico State University
Collaboration and Innovation Challenge (CIC) Posters

A number of CIC teams provided images of their posters for inclusion in the program. The CIC Posters will be displayed in Atrium area during the conference.

CIC# 02 “Individual Mobility Solution for the Future MOBIT”
ITESM-Estado de Mexico & Politecnico di Torino

MOBIT
Campus Estado de Mexico

Individual Mobility Solution for the future: Mobit

One of the main problems in Mexico City is the number of cars circulating on the roads, generating traffic and air pollution. In 2016, the number of vehicles registered in Mexico City was 8,950,000 while the population in the metropolitan area is about 42 million people.

Target: People who seek or study with the need of moving through Mexico City. This vehicle will be able to travel short distances (10km as maximum) with no driving restrictions (women wearing skirts can use the vehicle comfortably, for example).

In order to enhance the security of the vehicle, the team designed a high-quality shock absorber system components based on the ISO and safety standards. Another fundamental component of the vehicle is the energy and analysis of the traffic load of the area. The allocation of all the components is necessary because of its lightweight, quality, reliability and because it is easy to perform maintenance operations with it.

The following specifications have been set:
- Speed limit: 20 km/h (limited electronically for user’s safety).
- Engine weight: 15 kg (reduced weight to 15 kg by hybridization and reduction of internal components).
- Electrical hub motor with a power of about 300W (brakes: up to 2 hours).
- Electrical braking system based on a regenerative.

As a result of the service, a mobile application will be available for the users to register and to locate the nearest charging stations. When the different regions are populated and popularly we can take the idea to other cities or even other countries.

A microcontroller will be used for controlling the different systems of the vehicle and to make sure people have access to a great variety of interfaces.

The main problems that arise are the following:
- Reduced mileage of the vehicle (minimum range of 60 km).
- Bad condition of the battery when hybridization.
- Limited maintenance of the vehicle.
- Poor performance of the vehicle (vibration inside the vehicle).

As the system does not rely on transmission of the transmission at the city level could be significantly reduced.

End-user design, economics, and power sources. The existence of charging stations for electric vehicles should be the electric network (plug connectivity).

When the MOBIT is integrated, quality control equipment would be in charge of ensuring that the distance is correctly pathed. Additionally, new features will be added (technological, ecological, and economical) that would be tested for reliability purposes.

Regularity and service are the main values of the project, with a focus on the vehicle that allows the city to have a sustainable mobility and impact of the different research and companies involved in the development of mobility entities, and finally, the actual recycling processes.
Collaboration and Innovation Challenge (CIC) Posters

CIC# 04 “Capacity Optimization for Isolated Intersections by Adaptive Control Systems”
Hunan University
Collaboration and Innovation Challenge (CIC) Posters

CIC# 05 “Design and Simulation of G-Life Hybrid SUV”
Wuhan University of Technology
CIC# 06 “Modular Urban Driving System with Docking Mechanism (MUDS with Dock)”
Kookmin University
Collaboration and Innovation Challenge (CIC) Posters

CIC# 07 “Reconfigurable Vehicle for Seniors, Handicaps and All of Us with Strong Emphasis in Shared Use Concept”
Kookmin University (Team B)
Collaboration and Innovation Challenge (CIC) Posters

CIC# 08 “A Passenger Car with Easy Access”
Kookmin University (Team C)
Collaboration and Innovation Challenge (CIC) Posters

The following CIC projects also submitted for the Poster Session. Their images are shown in the Poster Session section above.

CIC# 19 “Designing, Modeling and Analysis of iREACTOR – Innovative Regenerative Electromagnetic Air Compressed Cogenerative Tesla Optimized Rotor Engine”
Sri Jayachamarajendra College of Engineering
See poster #56 in Poster Session section.

CIC# 35 “Designing, Analysis and Experimental Investigation of Electromagnetic Internal Combustion Hybrid Engine (CO-MAG-IC)”
Sri Jayachamarajendra College of Engineering
See poster #45 in Poster Session section.
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University of Texas at El Paso
Virginia Tech
Wayne State University

* Institutions in italics are not yet formally announced
2014 PACE Forum Delegate Information

Conference Theme:  “Rethinking Mobility”

Conference Dates:  Sunday July 26 – Friday July 31

Conference Location:  University of São Paulo – Escola Politécnica: Biênio  Anfiteatro Vermelho
Av. Prof. Almeida Prado, travessa 2, nº 158
Cidade Universitária – Butantã - São Paulo – SP
CEP: 05508-010 (23°33’21”S 46°43’55”W)

The conference main venue will be the Afiteatro Vermelho (Red Auditorium) at the J.O. Monteiro de Camargo Building (“Biênio”). Paper presentations will be held at the adjacent classroom block named “cirquinho” (see map). Posters will be displayed at the atrium of the Monteiro de Camargo building. Company displays will be at the area outside the main auditorium.

About São Paulo:
São Paulo is the largest city in South America, a megalopolis of nearly 20 million people. It is the capital of the State of São Paulo, Brazil’s most populous and wealthiest state. The city is Brazil’s main financial hub and its most cosmopolitan city, with top-rate nightlife (there are more than 15,000 bars) and restaurants (12,500 venues, covering 52 types of cuisine) and impressive cultural and art scenes. It is home to the largest Italian, Japanese and Arab Diasporas.

The language is Portuguese. Most of the citizens do not speak a foreign language. However, they will try to understand a foreign person or will ask for help to assist the visitor. Do not be shy – do try to interact. In business districts and areas near hotels it will be much easier to find people able to communicate in English or Spanish.

Visitor Information:
The Official Tourism Website of the City of São Paulo provides plenty of useful information - http://www.cidadedesaopaulo.com/sp/en

Climate:
São Paulo has a humid subtropical climate. The average daily high for July is 22°C (71°F) and the average daily low is 12°C (53°F). The record low for July was 1.5°C (35°F) and the record high for the same month was 29.7°C (85°F). In Brazil, July is the middle of winter. For daily weather forecasts, check http://www.bbc.com/weather/3448439?day=1

Maps:
São Paulo area is fully covered by Google Maps & Google Street View.

Electricity:
In São Paulo electricity is 110 V, 60Hz alternating current. Visitors may need to bring a plug adapter. (http://www.power-plugs-sockets.com/brazil/ ). Wall power outlet:

Plug adapter (US – Brazil)
Public Transportation

**Buses:** There are more than 10,000 buses in São Paulo. Most of the time, it is a good way to travel around the city, however, during rush hours the crowds and traffic will be very heavy.

You can buy your ticket inside the bus. The current fare is R$ 3.50 (~US$ 1.10) per ride. A great option is Bilhete Único, a card that can be purchased at lottery shops or at SPTrans desks. Passengers with Bilhete Único may travel in four different buses or subway trains every three hours paying a single fare.

There are lots of lines that travel to and inside the Cidade Universitária, that is, the place where Escola Politécnica is. The most relevant ones are the 8012-10 and the 8022-10 – their final stop is near to the Butantã Subway Station.

Google Maps provides useful information about the time tables and stops. For more assistance, check the SPTrans Website (http://www.sptrans.com.br/) or dial 156.

**Subway (Metro):** São Paulo’s Subway system is the easiest way to get around the city – there are stations near every major attraction and the trains are clean and safe. Nevertheless, avoid the subway during rush hours: it can be unbelievably crowded.

The lines operate daily from 4:40 A.M., and close around midnight. A single ticket costs R$ 3.50. There is no change of fare based on distance or time of travel. To avoid lines at ticket counters it is recommended to purchase your single tickets in advance.

Check the Metro Site for great information about the lines, stations and time tables (http://www.metro.sp.gov.br/en/your-trip/index.aspx ). The Metro SP Phone App can also be extremely handy.

**Train (CPTM):** CPTM covers both peripheral regions of the city and Marginal Pinheiros. Subway and train system connect at the following stations: Barra Funda, Luz, Brás and Santo Amaro. The connection with the subway is free, and the single ticket costs about US$ 1.10 (R$ 3.50). The Trains tend to be unsafe, especially during late night hours. For further information, check the CPTM Website (http://www.cptm.sp.gov.br/)

**Taxis:** Taxis can be a convenient – although much more expensive - way to move around since the vehicles can be allowed on some of the bus lanes to avoid congestion. You can simply hail a cab at the street or ask for one at your hotel front desk. Another very easy way to get a taxi is by smartphone app. (easytaxi, 99 taxis, for instance) All taxis are white. The driver has to put the meter on as soon as the ride starts.
Airport

The **São Paulo-Guarulhós International Airport (GRU)** can be reached both by car and by public transport. The airport lies 26 kilometres (17 miles) from the city centre, and connects with national and international destinations. Please refer to the airport website for further information: [http://www.gru.com.br/](http://www.gru.com.br/). Most international flights arrive and depart from Terminal 3.

**Taxi:** The easiest way to get to your hotel or to Escola Politécnica da USP from the GRU Airport is by taxi. You can easily find the booth of the airport taxi company just outside the terminal at the Arrivals Area.

The taxi fare to reach downtown São Paulo is about US$ 40 on lighter traffic hours. The fare can reach sensibly higher values during rush hours, that is, between 7 and 10 A.M. and from 5 to 8 P.M. Do not accept any other offers of taxis from the airport to the city. Go straight to the taxi company booth and show them your hotel address (It helps if you bring it printed). The taxi fare can be paid at the counter or to the driver.

The taxi company that serves the airport is Guarucoop - +55 (11) 2440 – 7700

Taxi booth at GRU Airport:

**Shuttle buses (EMTU – SP):** Shuttle Buses are available from the GRU Airport to different locations in the city. Most of the buses run every 30-45 minutes, depending on time of day. The departures are in Terminal 4. Tickets may be purchased in advance or inside the bus. Buses are comfortable (with Wi-Fi, air conditioning, assigned seats). However, from the bus destinations you may need to take a taxi or transportation to your hotel. The most relevant bus lines and their fares are listed here:

<table>
<thead>
<tr>
<th>Line Number</th>
<th>Final Stop</th>
<th>Fare (R$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>259</td>
<td>República (Subway Station)</td>
<td>42.00</td>
</tr>
<tr>
<td>316</td>
<td>Paulista/Augusta Hotels</td>
<td>42.00</td>
</tr>
<tr>
<td>437</td>
<td>Brooklin Novo (world trade center)</td>
<td>42.00</td>
</tr>
<tr>
<td>472</td>
<td>Barra Funda (Bus Station)</td>
<td>42.00</td>
</tr>
<tr>
<td>258</td>
<td>Congonhas Airport</td>
<td>42.00</td>
</tr>
</tbody>
</table>

Unfortunately there are no Train or Subway Stations near the GRU Airport – one must ride a bus to the nearest subway stations, which are Tatuapé (bus lines 257 or 299), República (bus line 259) or Tietê (the first stop of the 258 bus line).


Transportation to the Conference

During the PACE Forum shuttle buses will be available between the assigned hotels and the USP Campus. Buses will be marked and they will depart from the 3 hotel lobbies. The meeting times for the buses will be provided. Please refer to the PACE website for the latest information about the shuttle buses.

If you are not staying in one of the assigned hotels you can still use the shuttle buses, but you will need to be at the hotel stops at the right time.

There will be no shuttle buses during the pre-conference training. It is suggested to use public transportation or to take a taxi during this week.

Cars: Parking on campus is free.

To reach the university by public transportation you will have some options. The nearest subway station is “Butantã” (see map). From there, at the adjacent bus terminal, you can get the 8022-10. It will pass at the bus terminal inside campus near the Civil and Mechanical Engineering Buildings. To exit campus back to the Subway station you must take bus 8012-10.

Subway: Other lines serve the campus from several parts of the city. They all have their final stop at the bus terminal inside the campus near the Civil and Mechanical Engineering Buildings.

From the bus terminal all PACE Forum locations can be reached by a short walk as shown at the following map.
Post-Conference Tour Options

In São Paulo there is a huge offer of guided tours. This year there are no pre-arranged tours for the PACE delegates. Delegates need to arrange for their own tours. A few suggestions are listed below.

- **São Paulo Free Walking Tours** are available on Saturday and Sunday – for more information go to: [http://www.saopaulofreewalkingtour.com/](http://www.saopaulofreewalkingtour.com/)
  If you wish to arrange for a private group tour, you may arrange in advance, a fee is required.


- **Personal Tours** [http://www.personaltoursp.com.br/](http://www.personaltoursp.com.br/)

- **São Paulo Bike Tours** are available Saturday and Sunday [http://www.biketoursp.com.br/](http://www.biketoursp.com.br/)

All tours must be booked and paid directly with the tour companies. This year there are no pre-arranged tours for the PACE delegates. It may be possible to arrange for a small group tour, but you must arrange in advance. Your hotel may also be able to help you to arrange for a tour.
PRE-Conference Training

Training seats are limited and pre-registration is required. Confirmation of your successful enrollment in the requested training sessions will be emailed by July 10th. Attendees must arrange their own transportation and meals during training. Training classes are located at the Politecnico di Torino campus unless otherwise noted.

Training Option 1: Basic & Intermediate NX Design Including Assemblies with NX 10.0 for PACE Institutions

Dates: July 20-24 (Monday – Friday) 4.5 days  Instructor: Bob Chalou or Sam Kuan

Course Description: The first 1 ½ days are designed to give an entry level user an overview of NX modeling. This class, through instruction related to product design and master model concepts, allows the PACE faculty or student to transfer NX modeling instruction to in-class productivity. At the completion of the Basic Design portion of the class, the PACE attendee will be able to develop basic solid models as well as drawings using the master model concept. These concepts can be applied to product development and collaboration. The NX Basic Design class is designed to increase the productivity of the PACE faculty and student, teaching the necessary skills to accomplish the following: Open and examine NX models, create and edit parametric solid models, create and modify simple drawings. The last 3 days of the class build on the tools learned in the NX Basic portion of the course. Productive modeling techniques will be taught that help capture design intent. This course will include advanced sketching, face and edge operations, expressions, design logic, top-down assembly modeling, assembly functions and inter-part modeling. Topics included in this 4.5 day class include the NX User Interface, Direct Sketching, Expressions, Swept Features, Primitives, Reference Objects, Boolean Operations, Feature Modeling, Face Operations, Edge Operations, Editing Features, Drafting and Assembly Modeling.

Certification Exam: NX 10.0 Certification Exam
Dates: Friday July 24 13:15-17:00 pm  Instructor: Bob Chalou

ID REQUIRED: Note: Students / Faculty MUST bring picture ID to the test.

Training Option 2: Siemens Tecnomatix 11

Dates: July 20-22, Monday-Wednesday Noon, 2.5 days  Instructor: Nadia Galaske, TU Darmstadt
Location: University of São Paulo - Mechanical Engineering Building - Room A4.

Course Description: Day 1 & 2: 3D Digital Factory Planning and Simulation with Tecnomatix Process Designer & Process Simulate 11: Tecnomatix Process Designer and Process Simulate are digital manufacturing tools that enable collaborative project for planning, designing, simulating, and optimizing production processes. Process Designer provides a 3D environment for users to model production processes and develop a digital factory. Using the factory models created in Process Designer, Process Simulate allows users to validate manufacturing and assembly processes through 3D simulation of robotic and human operations. This course will introduce users to the basics of Tecnomatix Process Designer & Process Simulate. After completing this course, users should be able to plan and design a digital factory with 3D models using Process Designer as well as to create and perform simulations of robotic and human operations using Process Simulate.

Day 3: Simulation of production systems & processes with Tecnomatix Plant Simulation 11: Tecnomatix Plant Simulation is a discrete-event simulation tool for
the planning, realization, and establishment of production systems and processes, the flow of materials, and logistic operations. It is used for the exploration and optimization of systems’ characteristics for all levels of plant planning from workplaces at shop floor level, through local plants, to worldwide distributed production facilities. This course will introduce users to the basics of Tecnomatix Plant Simulation. After completing this course, they should be able to plan and perform material flow, information flow and logistics operations, to visualize statistics and reports, and to automate elementary tasks.

Training Option 3: Siemens Teamcenter
Dates: July 22-24, Wednesday NOON - Friday, 2.5 days  Instructor: Ruy Barancoski
Location: University of São Paulo - Mechanical Engineering Building - Room A4.

Course Description: This 2.5 day course on Using Teamcenter introduces the concept of product lifecycle management (PLM), provides instruction on working in the rich client interface, and the basics of using a suite of Teamcenter® software applications and perspectives. These perspectives include My Teamcenter, Structure Manager, Classification, embedded viewer, Change Manager, and Relation Browser.

Training Option 4: STAR-CCM+ for External Aerodynamics
Dates: July 22-23 (Wednesday & Thursday) 2 days  Instructor: Marco Lovatto

Course Description: This two day course will introduce users to our state-of-the-art CFD tool, STAR-CCM+. The training will take the user from complex geometry import, geometry remediation, preparation, meshing, and physics models to post processing of results. Training will provide the attendee with a clear picture of the rapid simulation process integrated within STAR-CCM+. This course will also include an introduction to our new Virtual Product Development (VPD) tool, OpenRoad™. OpenRoad™ provides students with both an interactive GUI-driven and batch driven process to calculate the Aerodynamic and/or Thermal Performance of ground vehicles in wind tunnels and the open road. This tool is free for academics and is perfect for the classroom and student design competition teams (Formula Student, FSAE, etc.).

Training Option 5: Basic Training: MATLAB and Simulink: Speeding up Engineering
Dates: July 20-21, Monday-Tuesday, 2-days, 9:00-18:00  Instructor: Rodrigo Botelho

Course Description: Introductory training for students in the application of MATLAB and Simulink for engineering projects. The attendee should be able to leverage the best use of MATLAB and Simulink, speeding up development and quickly implementing complex models and data analytics softwares. These tools are the standard in many companies and required for all engineering staff.

Training Option 8: Oracle Social Relationship Management for Market Driven Innovation
Dates: July 24, Friday morning, 3-hours  Instructor: TBD
Location: University of São Paulo - Mechanical Engineering Building - Room ES12 - Upper Floor.

Requirements: Bring your own laptop to this training class – computers will not be available.

Course Description: The Oracle Market-Driven Innovation Solution provides the ability for organizations to “hear” the Voice of the Customer across web and Social channels throughout all phases of the product development process. This training will cover tools to listen to the “Voice of Customer”, Create Social and Web “listening” filters, Uncover market needs, likes, and dislikes thorough social engagement.

Training Option A9: HyperMesh Pre-Processing for Finite Element Analysis
Dates: July 20-21, Monday/Tuesday 9:00 AM – 5:00 PM  Instructor: Karen Silva
Location: Local Altair Office: Rua Sampaio Viana, 277, 1º andar, Paraiso, Sao Paulo – SP 04004-000. Phone: +55 11 3884 0414
Course Description: This is an introductory course for using HyperMesh to create and set up finite element models for analysis. A combination of lectures and exercises will familiarize students to the HyperMesh environment, process, and suite of tools needed to start using HyperMesh in their work. This course is combined with the HyperView Introduction course on the final day as a training package. Topics include:
- Basic interaction with HyperMesh
- Preparing models for analysis
- Preparing geometry for meshing
- Shell meshing
- Creating hexa and penta mesh
- Tetra meshing
- Assemblies: welding and swapping parts

Training Option A10: Altair Optistruct Optimization
Dates: July 22-24 Wednesday/Thursday/Friday 9:00 AM – 5:00 PM  Instructor: Karen Silva
Location: Local Altair Office: Rua Sampaio Viana, 277, 1º andar, Paraiso, Sao Paulo – SP 04004-000. Phone: +55 11 3884 0414
Course Description: This is an introductory course for using OptiStruct for optimization in the product design process. Students will learn optimization concepts and do hands-on exercises for topology, topography, size, and shape optimizations. PREREQUISITE: HyperMesh Introduction
Topics include:
- Topology, topography, size and shape optimization concepts
- Pre-processing for OptiStruct using HyperMesh
- Linear static and normal mode analysis with OptiStruct prior to optimization
- Results visualization with HyperMesh and HyperView
- Topology optimization with manufacturing constraints
- Combined topology and topography optimization
- Geometric data generation of new design concept using OSSmooth
- Shape generation using HyperMorph which is a part of HyperMesh
- 2D and 3D shape optimization, as well as 1D and 2D size optimization

Our sincere thanks to the PACE Companies listed above for providing the training sessions for the 2015 PACE Annual Forum!

The PACE Companies listed above provide this convenient opportunity for the PACE Faculty and Students to attend these training sessions with no tuition fees.

Many thanks to University of São Paulo for providing the training facilities!