Best Papers

Best Paper Award Winners Announced for 2014 SPE® Automotive Composites Conference and Exhibition

The 2014 ***Dr. Jackie Rehkopf Best Paper Award*** winners for the ***SPE® Automotive Composites Conference & Exhibition*** (ACCE) achieved the highest average rating by conference peer reviewers out of a field of 83 contenders. Three winners — two speaking in the *Virtual Prototyping & Testing of Composites* technical session and one in the *Nanocomposites* session — will be honored for excellence in technical writing during opening ceremonies. Honorees Maxime Melchior, software development engineer at ***e-Xstream engineering***, an MSC Company took first place in this year's competition while Sylvain Calmels, business development manager - automotive at e-Xstream engineering and Keith Honaker, graduate student at ***Michigan State University*** and a 2013-2014 SPE ACCE graduate scholarship award winner were tied for second place. The authors or their representatives will receive a commemorative plaque for excellence in technical writing during opening ceremonies at this year's SPE ACCE. The conference's best paper awards have been renamed in honor of long-time SPE ACCE committee member, session organizer, two-times technical program co-chair, and long-time automotive composites industry researcher, Dr. Jackie Rehkopf who lost her battle with cancer this summer.

Dr. Maxime A. Melchior was lead author (along with Marc Duflot, Jean-Sébastien Gerard, Laurent Adam, and Roger Assaker all from e-Xstream engineering) on a paper entitled *End-to-End FE-based Homogenization of Woven Composites*, which will be presented by e-Xstream colleague, Dustin Souza on September 9 from 2:00-2:30 p.m. About his topic, Melchior explains that woven composites are represented by interlacing yarns impregnated by a resin matrix. Yarns are made of a resin matrix reinforced by continuous fibers. Homogenization of woven composites therefore requires two levels of homogenization: one for the yarn and another for the ply. Finite-element-(FE)-based homogenization at the ply level can be combined with mean-field homogenization at the yarn level to predict the mechanical behavior of a single ply. The main difficulty of this approach lies in the generation of a representative volume element (RVE) for a single ply. An end-to-end FE-based homogenization of woven composites has now been developed. A fully analytical framework based on mean-field homogenization also has been developed and interestingly this framework takes yarn curvature into account. The paper describes the newly developed tools, and the FE-based and mean-field homogenization predictions of linear properties are compared to experimental measurements on plain weave and 5HS woven composites.

Melchior joined e-Xstream engineering in 2011 and is currently involved in all of the company's initiatives involving the modeling of woven fabric reinforcements for composites. He received a Ph.D. in Applied Mechanics in 2009 from the Université catholique de Louvain (UCL). Melchior also did post-doctoral research at UCL on modeling the non-linear behavior of woven composites. He has authored or co-authored seven papers to date.

Sylvain Calmels was co-author with Benoît Bidaine, also from e-Xstream engineering of a paper entitled *Progressive Failure of CFRP Coupons and Automotive Parts*, which will be presented by e-Xstream colleague, Kurt Danielson on September 9 from 1:30-2:00 p.m. About his topic, Calmels explains that continuous-fiber-reinforced plastics, a category of composites, are considered to be the best choice for new concepts in automotive for parts that are subjected to the most severe loads. Simulations of such parts must then be able to reproduce the correct failure behavior of the composite for safety purposes. The aim of safety simulation is not only to detect the initiation of damage in the material, but to describe correctly its post-failure behavior. This paper addresses the application of a multi-scale material-modeling strategy to the specific needs of post-failure behavior simulation of continuous-fiber composite parts submitted to dynamic loads. The work demonstrates how simulation can be improved, for automotive safety design simulations in particular, helping to reduce design delays, cost, and weight of such structures.

Sylvain Calmels has worked at e-Xstream engineering for the past year as business development manager - automotive where he is responsible for understanding and anticipating auto industry needs in order to lead developments in the company's software product, *Digimat* to offer the best balance of accuracy and efficiency/speed needed by this market. Prior to joining e-Xstream, Calmels worked from 2006 to 2013 for PSA Peugeot Citroën as a methodology and FE modelization specialist where he worked on continuous improvement for FE tools and models and provided technical support for simulations involving body-in-white (BIW) structures and openings. Before that, he spent three years working for Alten Group providing technical support for FE simulations of BIW/openings for Alten client, PSA Peugeot Citroën. Calmels also worked as an FE simulation engineer for Bertrandt Group from 2000-2004 serving customers in the automotive and aeronautics industries. He is a 1998 Graduate Engineer with a specialization in structural analysis from École Centrale de Nantes (ECN) in France. Interestingly, this is the first paper he has authored or co-authored.

Keith Honaker was lead author (along with Frédéric Vautard and Lawrence T. Drzal, also of the Composite Materials and Structures Center at Michigan State University as well as Lang Sui of the Hyundai-Kia America Technical Center, Inc.) on a paper entitled *Processing Methods of High Density Polyethylene-Exfoliated Graphene Nanoplatelet Nanocomposites for Automotive Fuel Tank Applications*, which Honaker will be presenting from 10:00-10:30 a.m. on September 9. About his topic, Honaker explains that the paper discusses high-density polyethylene (HDPE)–exfoliated graphene nanoplatelet composites, which were synthesized and tested to measure their mechanical and barrier properties. To overcome limitations of melt extrusion, multiple processing techniques were investigated, including microlayer co-extrusion and solution mixing with sonication. Additionally, multiple modifications to the nanocomposites constituents were investigated, including cryo-milling the HDPE pellets and coating the platelets with a wax or polyolefin elastomer before extrusion processing. Honaker's research on this project was partially funded by his 2013-2014 SPE ACCE graduate scholarship.

Honaker earned a B.S. degree in Chemical Engineering from Kettering University. During his studies there, a co-operative work experience at Argonne National Laboratory synthesizing polymer composites for fuel-cell bipolar plates and testing materials for their use in the cathode of lithium-ion batteries got him interested in composites. After graduating, Honaker moved to Michigan State University where he is currently a third-year doctoral student. For the past two years, his work has focused on enhancing properties of a polymer matrix with graphene nanoplatelets for automotive fuel tanks. Upon graduating with his doctorate, Honaker hopes to work in industry.