Agency Update
DMACE Challenge

December 14, 2010

UCSB Team Advances Digital Manufacturing, Wins DARPA Challenge
$50,000 Prize awarded in DARPA DMACE Challenge

A team from the University of California, Santa Barbara has successfully modeled correlations in digital manufacturing processing (DM) that may lead to advances in manufacturing and cut costs for the Department of Defense. The effort was part of DARPA's Digital Manufacturing Analysis, Correlation and Estimation (DMACE) Challenge. The DARPA DMACE Challenge was a program developed and managed by DARPA's Service Chiefs' Fellows, a team of seven military officers and one government civilian representing all four military services.

Competitors were challenged to develop models that predicted the maximum compressive load that could be supported by digitally manufactured titanium spheres and polymer cubes. A wide variety of mathematical and engineering methods were used to develop predictive models with the goal of advancing knowledge of the potential capabilities and limitations of DM processes. The UCSB team created accurate models to predict the output properties of both structures created by DM processes.

Leo Christodoulou, director, DARPA Defense Sciences Office, stated that "DARPA and its Service Chiefs' Fellows also established a significant repository of open-source data for digital manufacturing. This collection of open-source data, if expanded, has the potential for accelerating the understanding of DM processes with regard to their output products and may enable processes leading to the certification and approval of DM components for use in military systems."
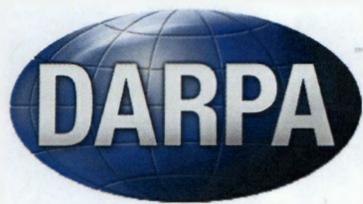
"The span of modeling approaches taken by the contestants, from purely data driven to physics based approaches, has served to illustrate the range of viable methods available to predict the properties of DM manufactured components," explained Gill Pratt, program manager, DARPA Defense Sciences Office.

The UCSB Team won the challenge using finite element models for both structures and will be awarded the $50,000 Prize for the DMACE Challenge. The UCSB team was led by Professor Frank Zok, and included Professor Matt Begley as well as PhD students Nell Gamble and Chris Hammetter.

DARPA would like to extend its gratitude to Naval Post Graduate School in Monterey, California and Oak Ridge National Laboratory in Oak Ridge, Tennessee for their support during the challenge.

DMACE Challenge information can be found on website at www.DMACE.net.

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DARPA Announces the Digital Manufacturing Analysis, Correlation and Estimation (DMACE) Challenge
$50,000 prize offered for the most accurate predictive model

Advances in digital manufacturing (DM) may address cost and time constraints associated with manufacturing the complex components required to support the Department of Defense mission. With the ongoing development of DM, a better understanding of the capabilities and limitations of DM is needed. The Defense Advanced Research Projects Agency (DARPA) Digital Manufacturing Analysis, Correlation and Estimation (DMACE) Challenge is a competition designed specifically to use crowd sourcing to advance knowledge of the potential capabilities and limitations of DM.

Within the Challenge, competitors will develop models that predict the output properties of products created by a DM machine based on corresponding machine inputs. The Challenge could be solved by applying any of a wide variety of engineering, mathematic or other approaches to predictive modeling.

"Widespread acceptance of DM components requires first that we determine whether predictive correlations exist between DM settings and resultant product properties," said Gill Pratt, DARPA program manager. "If a predictive correlation model is found, there is potential to change defense manufacturing significantly. If a manufacturer can predict the reliability of a component part with a high degree of certainty, DM could be used for all sorts of system components."

The DMACE Challenge requires participants to develop the most accurate DM output predictive models given a set of input parameters for two different computer aided designs (CAD): one for a sphere (digitally manufactured with titanium) and another for a cube (digitally manufactured with polymer). Data describing the input settings for a particular digital manufacturing process and the resultant output of structural tests will be distributed by DARPA online. Input setting data may include, but is not limited to device control parameters, material composition, and CAD files. Output test data may include, but is not limited to structural load test results such as stiffness, strength, and displacement data. These data sets will be provided on the DMACE website to registered individuals and teams.

Data to enable correlation model development by competitors will be released incrementally starting on or about October 29, 2010 and will continue through December 1, 2010. Competitor models will be evaluated through some final design parameter changes that will be posted on the www.DMACE.net website towards the end of the competition. After the final configurations are posted to the challenge website, competitors will have a short amount of time to use their models to provide predictions of test results for the two final test articles. The competitors' predictions and models will comprise their Challenge entry. The competition will award a $50,000 prize and singular recognition to the person or

team that most closely predicts a specific property of both of the final test products. Submission entry times will be used as a tie-breaker for matching entries.

DMACE Challenge information and registration will be available on the DMACE Challenge website at www.DMACE.net. Additional information for the DMACE Challenge may be found on Facebook and Twitter.

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