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Kirk E Jordan* (kjordan@us.ibm.com), 1 Rogers Street, Cambridge, MA 02142. *The Importance of the Math Formulation for Modeling and Simulation of Industrial Strength Problems on Peta and Exascale Systems.*

As industry scientists and engineers tackle more complex problems involving multiphysics and multiscales and then seek to solve these problems through computation, the math formulations which incorporate and more closely approximate the complex physical or biological phenomena being modeled will also be important to unlocking the approach taken on future computer systems. I will describe some of the challenges that will need to be considered in designing Petascale and eventually Exascale systems. Through the combination of High Performance Computing (HPC) hardware coupled with novel mathematical and algorithmic approaches emerging from the original formulations some efforts toward breakthroughs in industrial strength science and engineering are described. While there is progress, many challenges for the mathematical and computational science community to apply HPC to science problems of industry with impact on society remain. In conclusion, some discussion not only on the most obvious way to use ultra-scale, multi-core HPC will be given but also some thoughts on incorporating more physics in the algorithms derived from the math models and a glimpse at how to make such systems more accessible which might allow us to better use them to tackle previously intractable problems. (Received September 16, 2011)