Effective Modelling of Multi-Phase Continuum Systems

Prof. Arnaud Malan
University of Cape Town

Date: 11 December 2012 (Tuesday)
Time: 3.00pm – 4.00pm
Venue: MAS Executive Classroom 1, MAS-03-06
School of Physical and Mathematical Sciences

The effective modelling of strongly coupled multi-phase continuum systems is currently an area of key interest in engineering. This talk presents novel computational fluid dynamics (CFD) technology by which to model complex systems which range from multi-species porous systems to fluid-structure-interaction and free-surface-interaction. A set of unified volume-averaged local thermal-disequilibrium governing equations are proposed to describe the general case. All non-linear variations in phenomenological coefficients are fully and accurately accounted for. Numerical techniques are developed to effect efficient discretization, and sparse solvers constructed to achieve fast and efficient solution on massively parallel computing platforms. The efficacy of the technology is demonstrated via application to engineering challenges of the day. These range from hygroscopic porous materials with and without phase change, to non-linear aeroelastics and low mach number fluid-structure-interaction. High resolution accuracy and robust efficient modelling is demonstrated.

Speaker Biography
Dr. Arnaud Malan’s field of work is development of Computational Fluid Dynamics (CFD) modeling software for industry. Malan has published more than 80 conference and journal papers, and has been the recipient of numerous prestigious awards viz. fellowships from the Massachusetts Institute of Technology and Association of Commonwealth Universities, as well as a Visiting Scientist award from The Royal Society. Malan serves on the editorial board of Int. Journal for Numerical Methods in Heat & Fluid Flow, acted as Vice President of the South African Association for Theoretical and Applied Mechanics and is co-founder of the international African Conference on Computational Mechanics (AfriComp).

Host: Assistant Professor Wang Desheng, Division of Mathematical Sciences, School of Physical and Mathematical Sciences