

TEMPLE UNIVERSITY  
Department of Mathematics

# Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

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## Reservoir Modelling: Key Challenges and Recent Advances

by Alexandr Lukyanov

Schlumberger-Doll Research, Cambridge, MA

### **Abstract.**

Reservoir simulators have to be very robust, scalable and fast. However, due to the different geological structures and properties of oil and gas reservoirs and the use of enhanced oil recovery (EOR) techniques, the governing equations are strongly non-linear and hard to solve. There is a number of challenges associated with mathematical models describing physical processes and solution strategies. For example, the Jacobian system is solved usually by using FGM-RES preconditioned by the two-level Constrained Pressure Residual (CPR) preconditioner. The driving force of the CPR preconditioner is the solution of the pressure equation. The industry standard for solving the pressure equation is the Algebraic Multigrid (AMG) solver. AMG is well known for its parallel efficiency when increasing the problem size (weak scalability). However, this does not hold for a fixed problem size when increasing the number of computing nodes (strong scalability). This degradation in scalability is due to the increased level of communication in the algorithm, which leads to a key problem at a linear solver stage. This talk will describe the key computational challenges and recent advances in solving them, including multiscale modelling, meshless deflation, flash calculations etc.