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Autonomic Closure for Turbulent Flows Using Approximate Bayesian Computation OLGA DORONINA, JASON CHRISTOPHER, PETER HAMLINGTON, Univ of Colorado - Boulder, WERNER DAHM, Arizona State University — Autonomic closure is a new technique for achieving fully adaptive and physically accurate closure of coarse-grained turbulent flow governing equations, such as those solved in large eddy simulations (LES). Although autonomic closure has been shown in recent a priori tests to more accurately represent unclosed terms than do dynamic versions of traditional LES models, the computational cost of the approach makes it challenging to implement for simulations of practical turbulent flows at realistically high Reynolds numbers. The optimization step used in the approach introduces large matrices that must be inverted and is highly memory intensive. In order to reduce memory requirements, here we propose to use approximate Bayesian computation (ABC) in place of the optimization step, thereby yielding a computationally-efficient implementation of autonomic closure that trades memory-intensive for processor-intensive computations. The latter challenge can be overcome as co-processors such as general purpose graphical processing units become increasingly available on current generation petascale and exascale supercomputers. In this work, we outline the formulation of ABC-enabled autonomic closure and present initial results demonstrating the accuracy and computational cost of the approach.

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