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Artificial neural networks for chemistry representation. Part 2: Application in LES of turbulent reacting flows CHRISTOPH SCHMITT, MATTHIAS IHME, HEINZ PITSCH, Stanford University — Numerical simulations of turbulent reactive flows often involve thousands of reactions among hundreds of species. Flamelet based combustion models or intrinsic lower-dimensional manifold (ILDM) methods employ a reduced set of scalars for the representation of all thermochemical quantities. In these methods, table look up techniques are often employed for the representation of all species. The major limitation of this method is the tremendous memory storage requirement when the number of independent scalars becomes larger than four. In order to overcome this limitation, a method for the generation of optimal artificial neural networks has been developed. The major advantage of this method is that an optimal architecture is automatically identified, which results in the lowest approximation error while guaranteeing considerable savings in memory storage. An optimal ANN is generated for the representation of a complex methane/air chemical mechanism, which is employed in LES of turbulent jet flame simulations. Results are compared with conventional tabulation techniques and experimental data. Sensitivity of the statistical flow field quantities are presented and accuracy requirements on the chemistry representation are highlighted.

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