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Michael J. Wright
Senior Research Scientist
Reacting Flow Environments Branch
NASA Ames Research Center, M/S 230-2
Moffett Field, CA 94035-1000

Dear Dr. Wright,

I would like to express my very strong support for the NASA Ames Data-Parallel Line-Relaxation (DPLR) computational fluid dynamics code. I have been using DPLR for the past five years, and I have found it to be the most efficient, accurate, and robust code for the simulation of hypersonic and high-enthalpy flows. To my knowledge, it has the widest range of thermo-chemical kinetics models, gas-surface interaction models, and flux evaluation methods available in US CFD codes. DPLR has been central to my research program and has enabled me to solve a wide range of problems in hypersonic aerodynamics and planetary entry aerothermodynamics. Clearly, I strongly feel that DPLR should be recognized with the NASA Software of the Year award.

My area of research is the numerical simulation of hypersonic and high-temperature flows with application to air-breathing scramjet technology development and planetary atmospheric entry. My research is funded by the Air Force Office of Scientific Research (AFOSR), the Defense Advanced Research Projects Agency (DARPA), Sandia National Laboratories, the Army Research Laboratory, NASA, and the National Science Foundation. The DPLR code is absolutely essential to my research program. For example, my students and I used DPLR to design the inlet for a DARPA-funded Mach 10 scramjet test vehicle that will be flown on a sounding rocket this June. DPLR made it possible to perform a series of CFD simulations over a two-week period to optimize the inlet geometry and to understand the effects of various design parameters. DPLR was able to provide solutions on 3.3 million point grids in just 3 hours on a 32 processor AMD Opteron cluster. This rapid and reliable turn-around of solutions allowed us to design an inlet that greatly exceeded the performance of the baseline theoretical design.

Just as importantly, the numerical method that underlies DPLR has been central to my research program over the past several years. The DPLR method allows converged solutions to be obtained very rapidly, without any dependence on the grid stretching. Thus, it is ideal for use on high-speed, high-Reynolds number flows where extreme grid stretching is required to resolve thin shear layers and boundary layers. My students and I have adapted the line-relaxation method in DPLR to unstructured grids, allowing the simulation of geometrically complicated problems. For example, under JPL support we are using this new code to evaluate supersonic parachute performance with application to the forthcoming Mars Science Laboratory mission. Simply put, the DPLR numerical method has enabled these simulations. It would not have been possible to develop this code without the underlying numerical techniques and implementation approach that is in DPLR. Thus, my research program is indebted to the DPLR code and to NASA's support of DPLR.

DPLR is now making its way into the US aerospace industry. Boeing is evaluating DPLR for multi-disciplinary hypersonic inlet design and optimization. Northrop-Grumman is using it to provide high-quality flow solutions for stability and transition analysis of re-entry flows. In both applications, DPLR is performing extremely well.

I very strongly support the DPLR code and highly recommend that it be named NASA Software of the Year. It is an enabling tool for performing research in hypersonic flows, and it rapidly provides accurate results for aerothermal design problems. It genuinely makes the CFD analyst more productive, providing reliable high-quality answers with minimum turn-around time. The recognition that this award would bring to DPLR would expand its use in NASA and within the US aerospace community.

Sincerely,

Graham V. Candler
Distinguished McKnight University Professor