OVERVIEW OF THE NCC

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A multi-disciplinary design/analysis tool for combustion systems is critical for optimizing the low-emission, high-performance combustor design process. Based on discussions between then NASA Lewis Research Center and the jet engine companies, an industry-government team was formed in early 1995 to develop the National Combustion Code (NCC), which is an integrated system of computer codes for the design and analysis of combustion systems. NCC has advanced features that address the need to meet designer's requirements such as "assured accuracy", "fast turnaround", and "acceptable cost". The NCC development team is comprised of Allison Engine Company (Allison), CFD Research Corporation (CFDRC), GE Aircraft Engines (GEAE), NASA Glenn Research Center (LeRC), and Pratt & Whitney (P&W).

The "unstructured mesh" capability and "parallel computing" are fundamental features of NCC from its inception. The NCC system is composed of a set of "elements" which includes grid generator, main flow solver, turbulence module, turbulence and chemistry interaction module, chemistry module, spray module, radiation heat transfer module, data visualization module, and a post-processor for evaluating engine performance parameters. Each element may have contributions from several team members. Such a multi-source multi-element system needs to be integrated in a way that facilitates inter-module data communication, flexibility in module selection, and ease of integration.

The development of the NCC beta version was essentially completed in June 1998. Technical details of the NCC elements are given in the Reference List. Elements such as the baseline flow solver, turbulence module, and the chemistry module, have been extensively validated; and their parallel performance on large-scale parallel systems has been evaluated and optimized. However the scalar PDF module and the Spray module, as well as their coupling with the baseline flow solver, were developed in a small-scale distributed computing environment. As a result, the validation of the NCC beta version as a whole was quite limited. Current effort has been focused on the validation of the integrated code and the evaluation/optimization of its overall performance on large-scale parallel systems.

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