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Nonlinear dynamical modeling and simulation of axial compressors using bond graph

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In this paper, a way for nonlinear dynamical modeling of axial compressors using bond graph modeling method is presented. In many of academic and industrial problems, there is a need to model a system to analyze or design it. For this purpose, various methods are used. One of the most powerful of them is bond graph. Bond graph is a suitable device for modeling dynamical systems because it can model various domains of physical and even nonphysical systems. Therefore, it can model hybrid systems that contain various subsystems from different domains, such as mechanical, electrical, chemical and so others. Another advantage of it, is its capability to model nonlinear systems. For these reasons it has used for modeling many of dynamical systems. However, some systems have not been modeled by bond graph yet. One of them is axial compressor. It is a device that is used to increase the stagnation pressure of a compressible fluid. Nowadays, axial compressors are used in many systems that one of the most important of them is jet engines. Therefore, it is very useful that it can be modeled in such way that its behavior from the start point until the design point becomes recognized. In this paper, this system is modeled one dimensionally, for compressible, in viscid and isentropic flow in such way that its specifications in unsteady states along the time are specified. It means that from the time that it turns on in each stage of it, various specifications like pressure, temperature, energy and various velocities (in different directions) of the fluid, are known. Therefore, in this work, there is the novelty of modeling axial compressor in unsteady states, and it can be very useful for both analyzing and designing a compressor. Because by using it, a designed compressor, before hardware construction, can be modeled and its behavior in various scenarios will be observed without a need for hardware test that is very expensive.

Biography

Alireza B. Novinzadeh received the Ph.D. degrees in Aerospace from the University of Sharif, Tehran, Iran in 2004. He has been a Faculty member at K.N. Toosi University of Technology, Tehran, Iran since 2004. His Ph.D. research involved Closed-Loop Optimal Control in Nonlinear Systems. His core research interests are optimal control, Modeling and Simulation of System Dynamics, Applied Mathematics.

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