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ANALYSIS OF A COMPLIANT GAS FOIL SEAL WITH TURBULENCE EFFECTS

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ABSTRACT

A method is presented to include the turbulence effects in fluid flow analysis of a high speed compliant gas foil seal (CFS). The method takes into account certain well-established facts concerning turbulent shear flow. The compressible fluid flow field is assumed to depend on local film thickness, surface velocity, pressure gradient and surface compliance. The non-linear effects due to compliance of the flow boundaries, compressibility of the fluid, and coupling of the shear induced circumferential flow and pressure driven axial flow are considered. The turbulence effect is accounted for using non-linear coefficients in the coupled compressible governing equations of the flow pressure and film thickness. The computational method employs the successive over-relaxation (SOR) method for solving the governing equations of the flow field and fluid film thickness. No optimization study has been conducted for the rate of convergence in the numerical analysis. The relaxation factor is found to be a key parameter in convergence solution when the compliant foil seal is operating at high speed, high eccentricity ration or low differential pressure across the seal. It is found that due to non-symmetric boundary condition, the method of Column Matrix which is used for compliant foil bearing did not result in a convergence solution.