Foil bearings are a key component to mature the promising supercritical CO2 cycles and has been proven as an essential component for long duration tests at Sandia National Laboratories. Although the importance of foil bearings has been recognised, the flow physics within foil bearings operating with CO2 has received little attention. The flow phenomena within foil bearings is complex, consequently, the use of the conventional Reynolds equation for foil bearings is not adequate for CO2 applications.

To address these modelling issues, a three-dimensional multiphysics and multi-timescale computational framework including fluid flow, structural deformation, heat conduction and thermal expansion has been developed, coupled and applied to foil bearings.

The use of the developed computational framework has revealed the flow physics in foil bearings with CO2, including centrifugal inertia forces, turbulence effect, and non-ideal gas behaviour. Output of the work provides accurate steady state and dynamic performance predictions of foil bearings.

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