Effect of radial deformation of the outer cylinder on the transition from the Taylor-Couette flow

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Abstract :

A numerical study of the Taylor-Couette flow control is presented in this work. The study is devoted to investigate the effect of the outer cylinder diameter variation, on the flow behaviour. The numerical results are obtained using Fluent software package for the three dimensional and incompressible flow. The basic system, with a height H=200mm, a ratio of the inner and outer radii $\eta = 0.9$*, an aspect ratio, corresponding to the cylinder height reported to the gap length* $\Gamma = 40$ *and a ratio of the gap to the radius of the inner cylinder is* $\delta = 0.1$*. The motivation of this paper, in addition to its connection with the classical Taylor-Couette problem, is to develop new modeling techniques control flow problem, in terms of the critical value of the Taylor number,* Ta_{c1} *for the first instability. The scheme and the code are verified by comparison with the experimental results delayed by* ***Koschmieder*** *and* ***Bouabdallah*** *in the same conditions. The deformation of the outer cylinder diameter is executed using the dynamic mesh program. To realize this method we need a short UDF (user defined function) which constructed to modify the shape of the grid cells, create and eliminate the cells to ensure the desired deforming motion. It is established that the first instability mode of transition is retarded from* Ta_{c1}*=41.33, corresponding to the nominal case, to* Ta_{c1}*=70 when the deforming amplitude is equal to 15% of external cylinder diameter.*

Keys words*: Deforming Cylinder; active control, Fluent software; Taylor -Couette flow, Hydrodynamic instability.*