Abstract Submitted
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On the prediction of saturation states for flows in a corrugated channel with functionally graded heating[1] MOHAMMAD ZAKIR HOSSAIN, S.J. SHERWIN, Department of Aeronautics, Imperial College London, South Kensington Campus, London, SW7 2AZ, UK. — Functionally graded heating (FGH) is a type of heating where temperature of a surface is spatially distributed. Presence of FGH is ubiquitous in nature (e.g., atmospheric boundary layer as surfaces of different colours heat up at different rates forests/lakes combination in rural environments and roofs/streets in urban environments), and in engineering (e.g., discrete heat sources - systems of localised fires, computer chips, heating wires, etc.). FGH generates structured convection. To understand the character of this convection, a spectral/hp element algorithm is developed to solve the incompressible Navier-Stokes and advection-diffusion equations along with a flowrate forcing constraint. The flow bifurcation process is investigated using a linear stability analysis based on the time-stepper Arnoldi algorithm. The saturation states of the baseflow are identified by direct numerical simulation (DNS) where desired forms of disturbances are imposed into the baseflow. It is observed that the two-dimensional disturbances saturate to an oscillatory state whereas the three-dimensional disturbances saturate to a steady non-oscillatory state.

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