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Instability of secondary flows in an electromagnetically forced curved duct JEAN BOISSON, ROMAIN MONCHAUX, IMSIA, UME, SEBASTIEN AUMATRE, CEA/DSM/SPEC/SPHYNX — In this presentation, we investigated the secondary flow forced electromagnetically between two fixed copper cylinders. The gap geometry corresponds to a rectangular curved duct with a large aspect ratio. We have performed low Hartmann number runs ($M < 500$) and we used ultrasonic probes to access the azimuthal and axial velocity profiles. We have characterized a transition between magnetohydrodynamic and hydrodynamic regimes. These regimes are controlled by the Elsasser number. The hydrodynamic regime corresponds to a classic flow in rectangular curved duct presenting a single pair of stable contra-rotative vortices (2-cell mode) and shows a transition to double pair of vortices (4-cell mode) for large enough magnetic Dean number K_M (Dean number adjusted by the magnetic field). We have explored the experimental stability diagram for $100 < K_M < 600$ and we found a 2-cell/4-cell transition involving the coexistence of the two modes. Therefore we suggest that this MHD device is a good alternative to study flows in curved duct compare to helicoidal or U-turn devices. First, the range of accessible geometry is large. Then as this system is closed, the control parameter can be globally controlled allowing us to observe the flow for at a given forcing on long time scales.

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