FM11L_12387

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Feedback Control of Vortex Shedding in a Separated Diffuser

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We propose a closed-loop control algorithm for vortex shedding in a separated diffuser. We introduce pulses of zero-net-mass injection (consecutive blowing and suction) based on estimates of the circulation of a vortex in the separated region. The circulation is determined with an inverse detection algorithm based on pressure at a limited number of observer points at the wall. The closed-loop algorithm attempts to time the pulse so that the vortex is pinched off with an optimal size (determined through modeling and open-loop forcing). We investigate the performance of both open and closed-loop control in a simplified two-dimensional diffuser flow by using direct numerical simulation. We examine robustness by introducing high frequency disturbances upstream of the separation point. The disturbances significantly reduce the effectiveness of open-loop control compared to the case where no external disturbances are added. By using feedback control, performance is again recovered in the presence of disturbances.

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