Controlling shear flow generation in a transport model

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A one-dimensional transport model is used to study edge poloidal shear flow generation during gas puffing experiments and hysteresis effects in the generation of this flow. Gas puffing at the edge of the TJ-II stellarator has been used to control the development of an edge poloidal velocity shear layer [1] and study the threshold for flow generation [2]. The transport model couples together density, ion temperature, electron temperature, poloidal flow, toroidal flow, radial electric field, and a fluctuation envelope equation that includes a shear-suppression factor. All fields are integrated with a second-order modified Runge-Kutta method with adaptive time-stepping. Above a critical threshold the shear flow improves confinement by reducing turbulent transport. For subcritical flows (i.e., flows that do not trigger transition to a higher confinement regime), there is no true hysteresis in the flow [3]. An apparent lag may be observed if the rate of ramping the particle source is rapid relative to transport time scales. For critical flows, an edge transport barrier is formed and fluctuations are suppressed locally. Near the threshhold, the barrier location oscillates.

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