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Rapid Beam Shaping For Pulsed Laser Processing Using Tunable Acoustic Gradient Index Lenses CRAIG ARNOLD, ALEXANDER MERMILLOD-BLONDIN, EUAN MCLEOD, Princeton University — Rapid shaping of an incident Gaussian laser beam enables spot-to-spot control over local material properties in pulsed and CW applications. Here we present a new device, the tunable acoustic gradient index (TAG) lens, which provides a rapid, high throughput alternative for spatially modifying incident beams and we discuss its effect on pulsed laser micromachining. The TAG lens is a resonant cylindrical cavity for acoustic radial standing waves that modulate the density and thereby create a gradient in index of refraction within the filling fluid. With CW illumination, a single driving frequency will produce a multiscale Bessel beam, or under multiple-frequency operation it can generate a superposition of Bessel beams, approximating any radially-symmetric pattern. When synchronizing a pulsed laser illumination to the lens, rapid switching between instantaneous patterns at frequencies as high as 100-1000 kHz is possible. The theory behind the operation of the lens, its speed, and applicability to pulsed laser processing will be presented.

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