Effective boundary conditions for compressible flows over a rough surface

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Domains with microscopic rough boundaries frequently arise in applications in engineering. For instance, space shuttles are often covered with tiles, while small air injecting nozzles are used over wings of aircrafts to reduce the drag [4]. Examples can also be found in nature, e.g. the skin of sharks [2], and in everyday life, e.g. golf balls.

Direct numerical simulations of a flow over a roughness are prohibitively expensive for small scale structures. If the interest is only on some macroscale quantity, it is sufficient to model the influence of the unresolved microscale effects. Such multiscale models rely on an appropriate upscaling strategy, the so called homogenization technique [1,3]. In this talk the strategy originally developed by Achdou et al. [1] for incompressible flows is extended to compressible high-Reynols number flows. For proof of concept a laminar flow over a flat plate with partially embedded roughness is simulated.

References:

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