### Turbulence Generation in Wind Tunnel Possible Implementations from Literature and Ideas for Realizations

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## turbulence generation - realizations in literature

- without mean flow
  - vibrating grid
  - symmetric setup of fans
  - symmetric setup of speakers (synthetic jets)
  - array of synthetic jets (in water)
- with mean flow / in wind tunnel
  - passive grid
  - fractals
  - active grid
  - symmetric setup of speakers (synthetic jets)
  - high velocity jets

#### turbulence generation - realizations in literature setups without mean flow







Figure: box with 8 fans in each corner, Birouk 2003



Figure: water tank with two arrays of synthetic jets, G. Bellani 2014



Figure: pumps creating

# turbulence generation - realizations in literature setups with mean flow







Figure: different tested grids filling whole cross section, M. S. Uberoi 1967

Figure: fractal struxture filling whole cross section, R. Gomes-Fernandes 2012 Figure: rods with winglets, rods rotate in random mode, Larssen 2010

#### turbulence generation with high velocity jets



Figure: Thole 1994

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#### turblence generation with speakers







Figure: K. Chang 2011



Figure: W. Hwang 2004



Figure: C. Goepfert 2010

### windtunnel as planned by Henja



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#### possible setups in windtunnel - jets



Figure: possible arrangement of jets

to be found out:

- jets or synthetic jets better?
- possiblities for small synthetic jets in air
- best number of jets

### possible setups in windtunnel - speaker



Figure: Speaker arrangement in truncated cube



Figure: Speaker arrangement in cuboctahedron (max. possible speaker size with given size of section)

- 8 speakers can be arranged symmetrically
- cuboctahedron yields max.
   diameter of inner circle of triangles (11cm)
- bigger speakers possible if for example nozzle between speaker and wall

different types of synthetic jets with speakers







Figure: speaker with nozzle creating one synthetic jet

Figure: speaker with contraction creating one synthetic jet

Figure: speaker with grid for creating several small synthetic jets

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