

# START™

## Unsteady Aerodynamics Software

### START Software

- A Simple Tool for Aerodynamic Transients
- A specific pre-design tool for the estimation of unsteady aerodynamic effects on trains and structures

Start is developed and support by PRINCIPIA

### Application

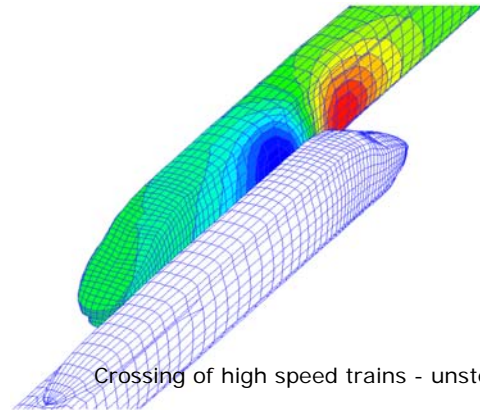
- Moving vehicles : trains, cars, trucks,submarins...
- Blowing effects on structures
- Crosswind shift effects
- Wake effects

### Theory and numerical methods

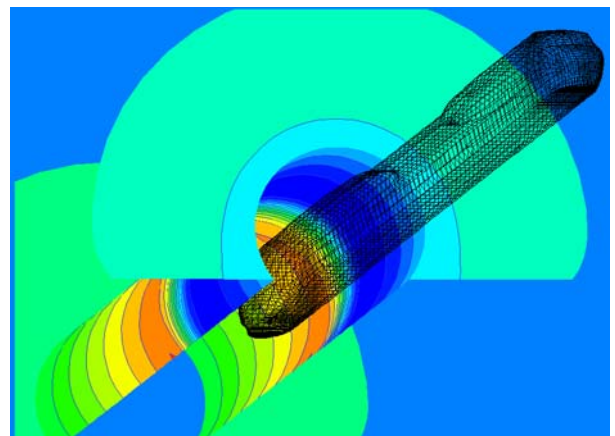
- Perfect fluid with boundary layer corrections
- Compressible or incompressible fluid in linearized theory
- Panel method with sources and doublets
- Wake effects captured by vortex sheets in equilibrium
- Powerfull matrix solver (double conjugated gradients) and bandwidth control.

### Results

- Pressure fields, velocity fields
- Steady and unsteady loads
- Time histories of pressure, velocity, loads on all the structure or punctual



Crossing of high speed trains - unsteady pressure field



Circulation of a high speed train in tunnel

### References

SNCF direction du materiel, Geste Engineering, Dbag, Bombardier, Alstom...

### Hardware configuration

PC Windows or Linux

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