# Trilinos/Belos

**Iterative Krylov-based solvers.** C++ permits one implementation that supports multiple scalar types and thread-parallel programming models.

- **Ability to solve single or sequence of linear systems**
  - Simultaneously solved systems w/ multiple-RHS: $AX = B$
  - Sequentially solved systems w/ multiple-RHS: $AX_i = B_i$, $i=1,\ldots,t$
  - Sequences of multiple-RHS systems: $A_iX_i = B_i$, $i=1,\ldots,t$
- **Standard methods**
  - Conjugate Gradients (CG), GMRES
  - TFQMR, BiCGStab, MINRES, fixed-point
- **Advanced methods**
  - Block GMRES, block CG/BICG
  - Hybrid GMRES, CGRODR (block recycling GMRES)
  - TSQR (tall skinny QR), LSQR
- **Ongoing research**
  - Communication avoiding methods
  - Pipelined and s-step methods

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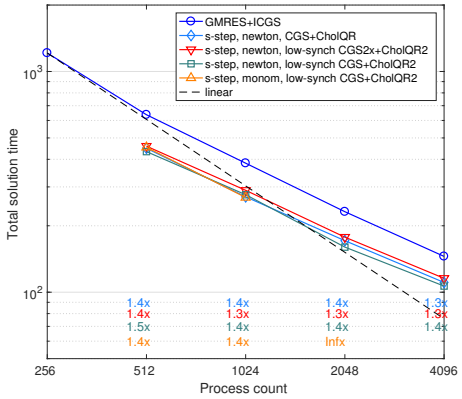
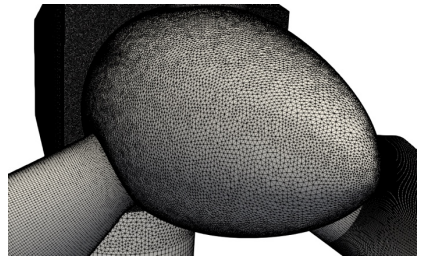
Results courtesy of M. Hoemmen and I. Yamazaki (SNL). Image from Thomas et al, "High-fidelity simulation of wind-turbine incompressible flows", to appear in SISC, 2019.




**Speed-ups of various s-step Krylov methods within low Mach CFD wind-energy code Nalu-Wind.**



**Close-up of Vestas V27 hub section and nacelle.**

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https://trilinos.github.io/belos.html