Benchmarking speed of aeroelastic analysis (Cloud to the rescue?)

Paul Thomassen (simis), Lene Eliassen (NTNU), and Loup Suja (Statkraft and NTNU)

Overview

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- Background: Benchmarking of aeroelastic software

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- Is benchmarking of analysis speed relevant?

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- Conclusion

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Analysis speed probably has a negative influence on design

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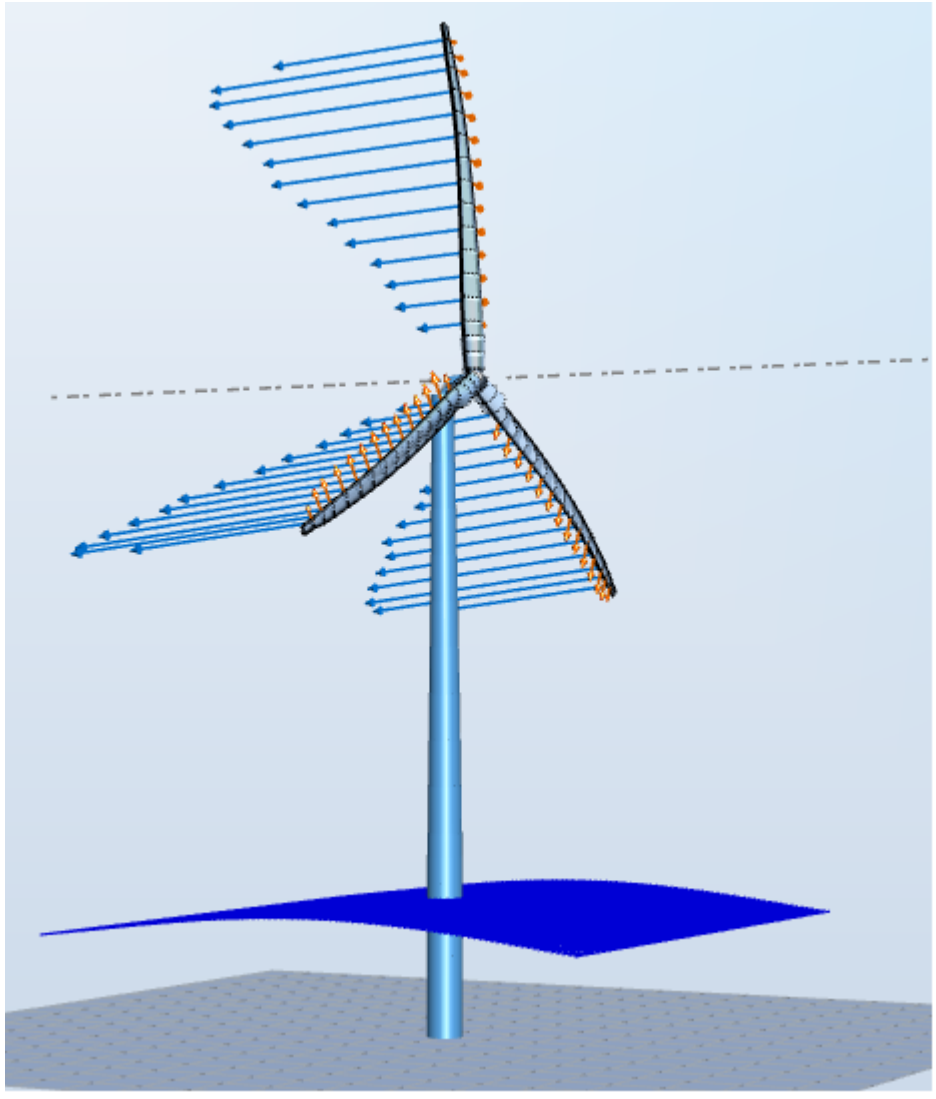
  - LC 4: turbulent wind, mean: 18m/s, regular waves: H=6m, T=10s

The model used for benchmarking.



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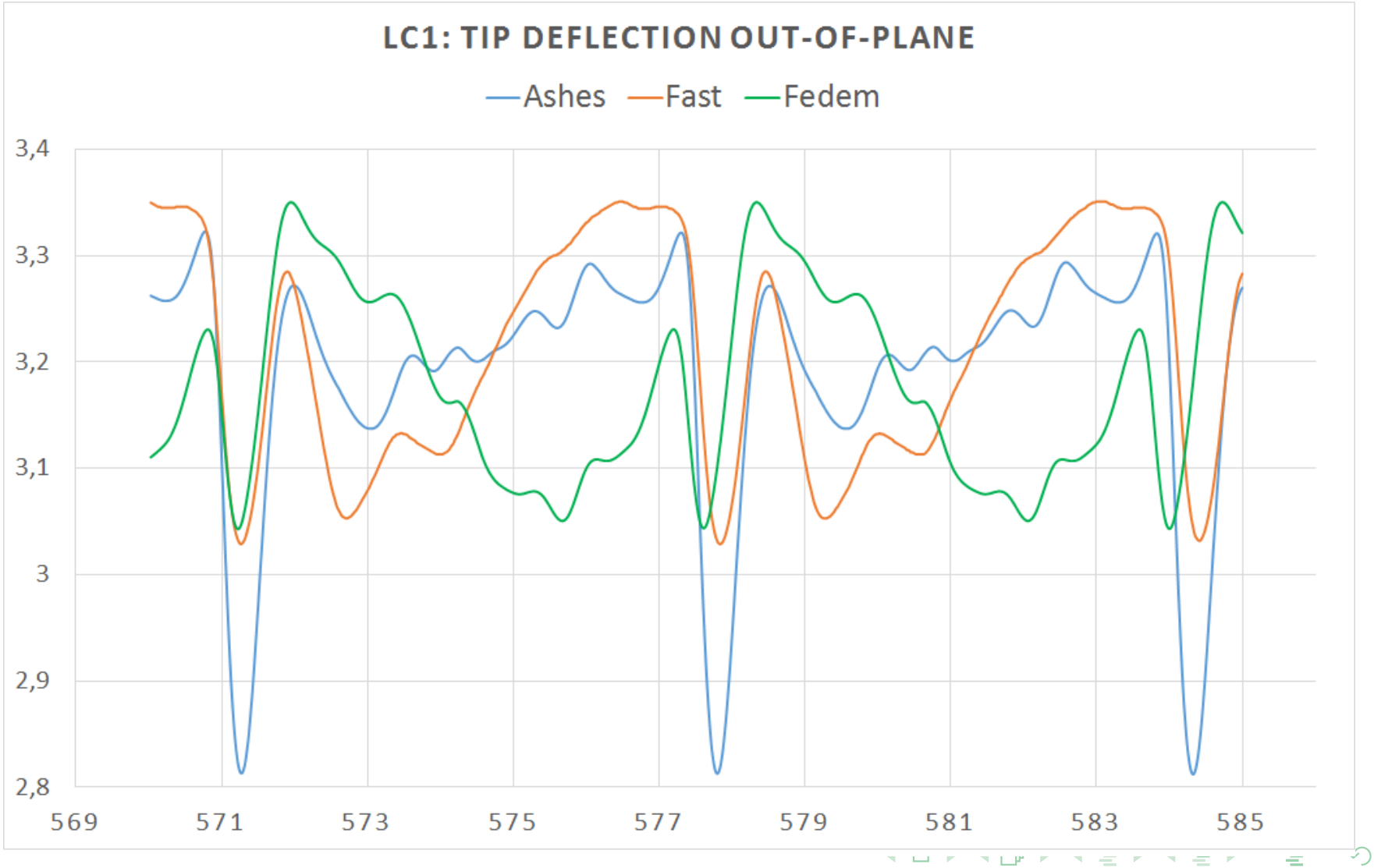
  - Fedem Windpower: 912 DOFs
  - Ashes: 1086 DOFs

Simplified benchmarking of analysis results: FAST v.8, Fedem Windpower, and Ashes.



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Wall clock	7:11	27:18	38:42
Speed factor	22	6	4
1000 LCs	7 hours	28 hours	40 hours

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- Modal code is 5 times faster than average of FEM/MBS codes

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	PC 1 (4 cores)	PC 2 (8 cores)
Wall clock	27:18	19:22
Speed factor	6	8
1000 LCs	28 hours	20 hours

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- Approximately same speed factor for other durations (6h, 12h)

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- Giants are competing on price for market share: Amazon, Google, Microsoft
  - Prices have been decreasing according to Moore's law
- More flexible than private clouds/clusters

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Wall clock	43:34	24:56
Speed factor	8	14
Cost	0	0.42 $/hour
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Extrapolation: Running 1000 LCs (10 000 min) in 1 hour on Amazon cloud costs $ 5.

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What are the implications of aeroelastic analysis becoming close to instant, and with a marginal cost close to nothing?