

Why Do Wind Turbines Make Swishing Noises?

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Process:

Abstract:

Wind turbines produce aerodynamic noise:

- Influences:

- Public acceptance
- Rotor size
- Siting

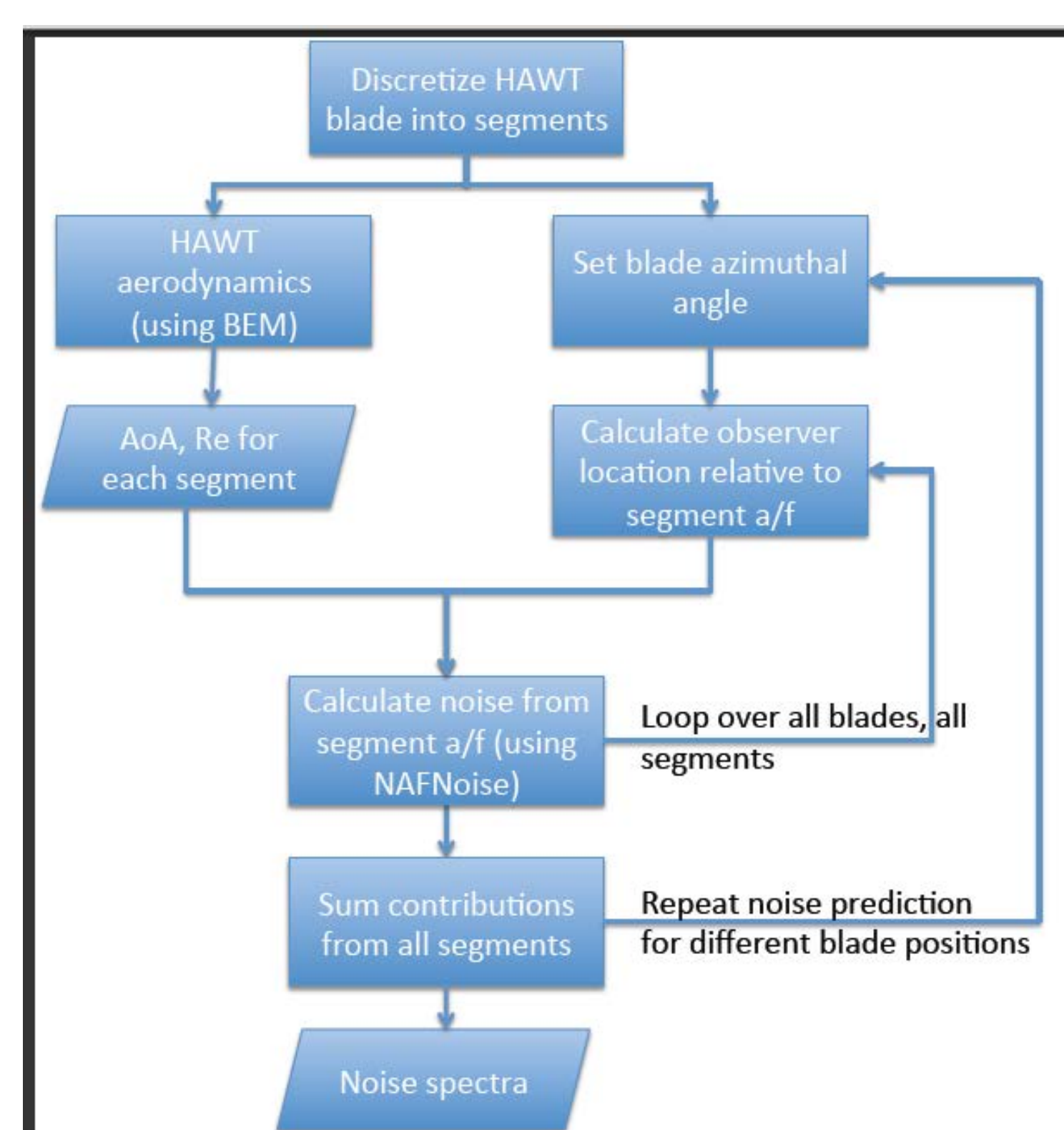


Need for reducing wind turbine noise

Experimental Methods:

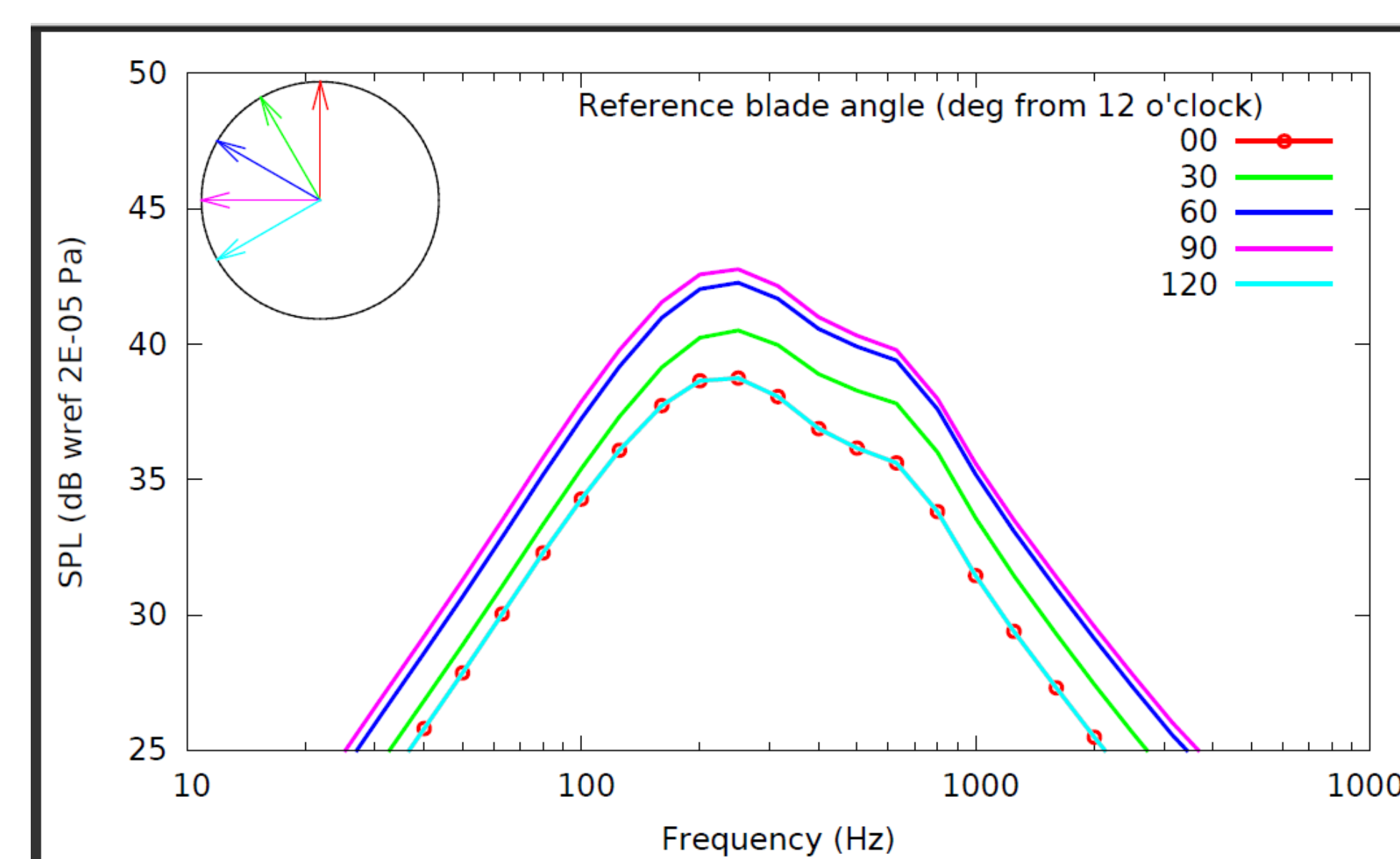
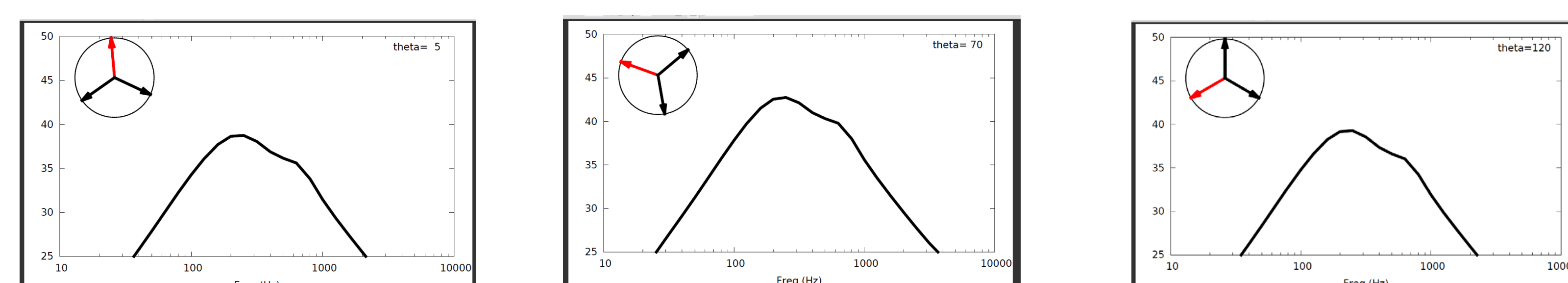
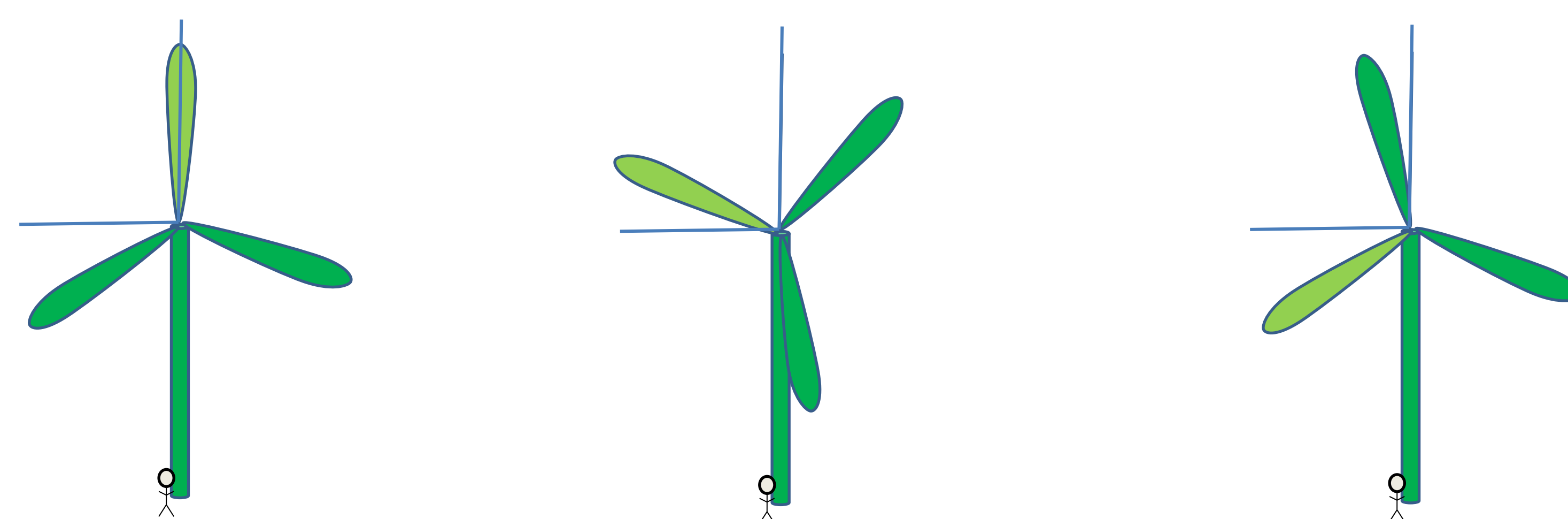
Developed a software that predicts aerodynamic noise from a Horizontal Axis Wind Turbine (HAWT)

Flow Chart Representation of code:



Results:

Noise levels at different blade positions
- models "swishing" noise

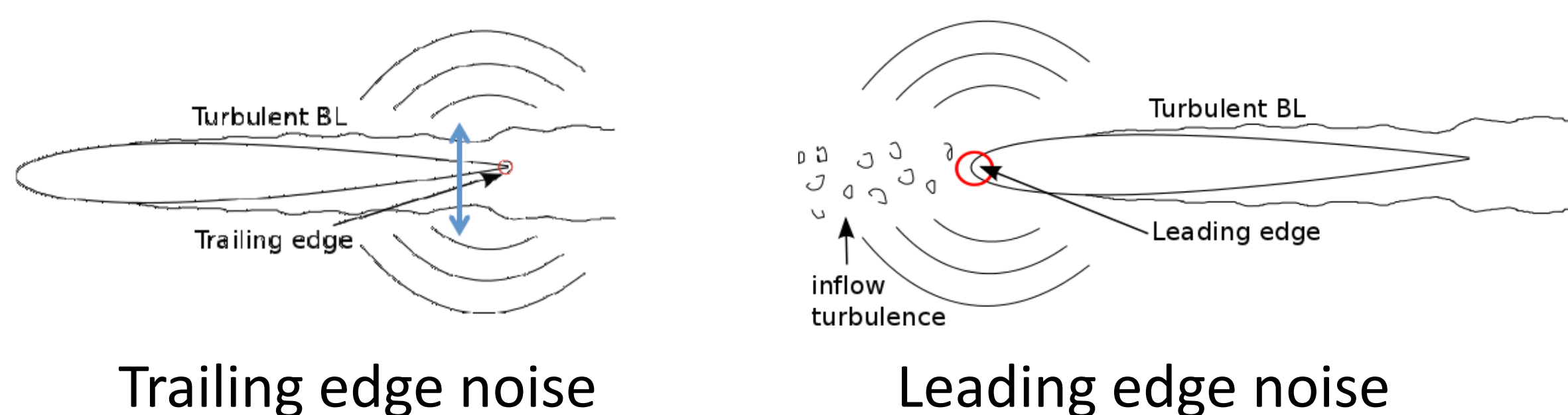


Noise comparison for various blade positions



Visualization of noise experienced by an observer on ground (Courtesy Oerlemans)

Key Aerodynamic Noise Sources:



Trailing edge noise

Leading edge noise

References:

Brooks, T., Pope, D., and Marcolini, M., "Airfoil Self-Noise and Prediction," NASA Reference Publication 1218, National Aeronautics and Space Administration, 1989

Moriarty, P., Migliore P., "Semi-Empirical Aeroacoustic Noise Prediction Code for Wind Turbines," National Wind Technology Center, National Renewable Energy Laboratory, 2003

Moriarty, P., "NAFNoise User's Guide," National Wind Technology Center, National Renewable Energy Laboratory, 2005

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Conclusions:

- Developed a software to model HAWT aerodynamic noise
- Demonstrated the phenomenon of blade swishing
 - Swishing due to amplitude modulation
- Software can be used for optimizing turbine micro-siting and operation

Further Work:

- Software will be extended to account for:
 - multiple observers
 - multiple wind turbines
 - and eventually full wind farms