

Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2022-108

Sven Schmitz (Referee)

Referee comment on "Generalized analytical body force model for actuator disc computations of wind turbines" by Jens N. Sørensen, Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2022-108-RC1>, 2023

Review of WES-2022-108

J. N. Sorensen : "Generalized Analytical Body Force Model For Actuator Disc Computations of Wind Turbines"

Leonardo DaVinci once said: "Simplicity is the ultimate sophistication." This seems to readily apply to the proposed generalized analytical body force model presented in the manuscript. Great work that has potential for significant impact. Well done.

Scientific Significance: The manuscript presents a generalized actuator disc (AD) model for use in wind farm simulations. The novel scientific aspect of the extended (i.e. generalized) model is that it enables AD methods for use at off-design (Region III) wind speeds, as opposed to be only valid for design (i.e. close to optimal) conditions in Region II. This merits not only publication in WES but also is potentially impactful to the broader community on wind farm wake modeling.

Scientific Quality: The mathematical methods used in the manuscript appear to be correct. All relevant information is given for the reader to implement the proposed model in independent analyses. The work is of the highest scientific quality, demonstrating physical insight into wind turbine aerodynamics at off-design conditions.

Presentation Quality: Good writing style w/o being excessive in the description of background, motivation, mathematical formulation, graphs etc. Very well done.

Minor Comments:

- Typos in lines 144, 282, 285, 326. Please doublecheck.
- Section 3.1: The author may consider revising the paragraph describing 'tuning' of the model. The reviewer would hope for a more physics-based explanation/description; at a minimum, what range of values are expected for S_0 and why?
- Page 14: Discussion of tangential loading seen in Figs. 5-7. The explanation in line 329 "for some unknown reason" is incomplete. Here again, the reviewer would expect some physics-based explanation for the observation. For example, is there a distinct difference in the design of the root region for the V27 in comparison to the V52 and NM80 ? If yes, then the behavior of the tangential loads can probably be explained. Please investigate a little further.