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**Publication date** 2022 **Document Version** Final published version

Citation (APA) Singh, D., Dwight, R. P., & Viré, A. C. (2022). *Probabilistic surrogates for floating wind-turbine load emulation*. Poster session presented at 2022 PhD Academic Event, Delft, Netherlands.

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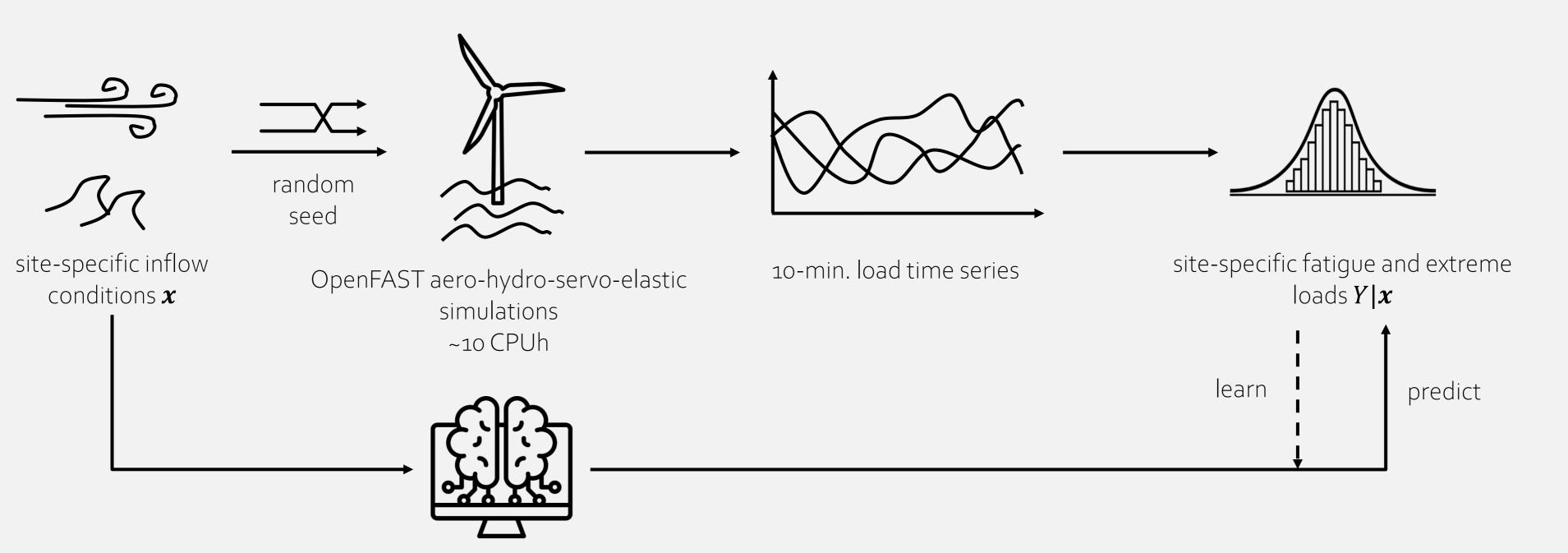
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# Probabilistic surrogates for floating wind-turbine load emulation

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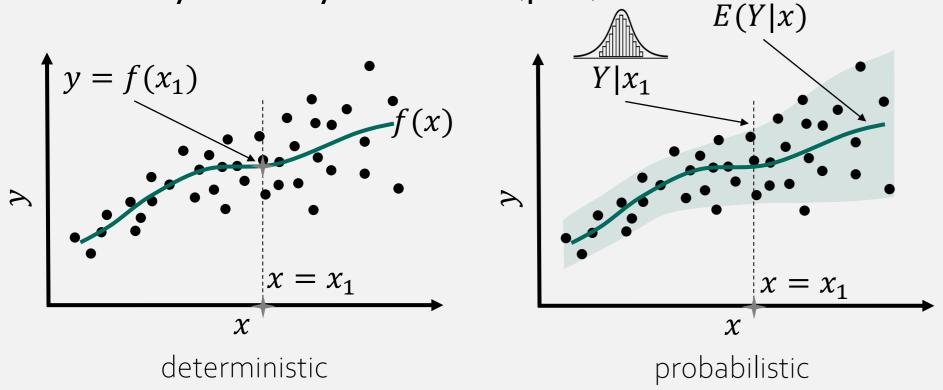
## OUTLINE



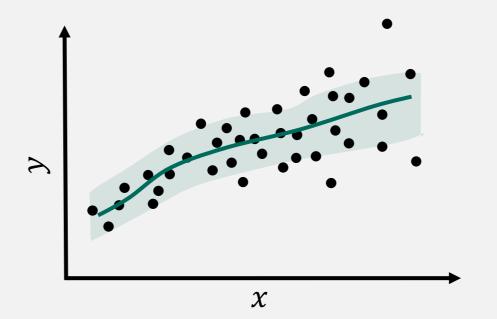
probabilistic surrogate model (lowcost approximation of the system) ~1 CPUs

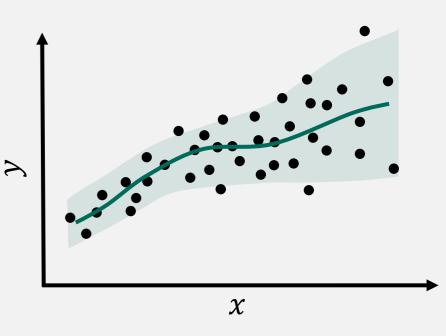
# APPROACH

In measurements and in simulations, the wind turbine is subject to randomly varying inflow conditions. For a set of mean inflow conditions *x*, the loads are not deterministic, but random variables of unknown probability density function (pdf).



### MODELS





Gaussian process regression (GPR)  $y_i = f(x_i) + \varepsilon$ 

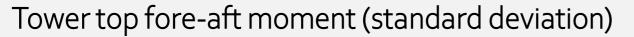
heteroscedastic Gaussian process regression (H-GPR)  $y_i = f(x_i) + \varepsilon(x_i)$ 

Bayesian statistical methods like the heteroscedastic Gaussian process regression can directly infer the underlying mean and variance of the pdf from a noisy database.

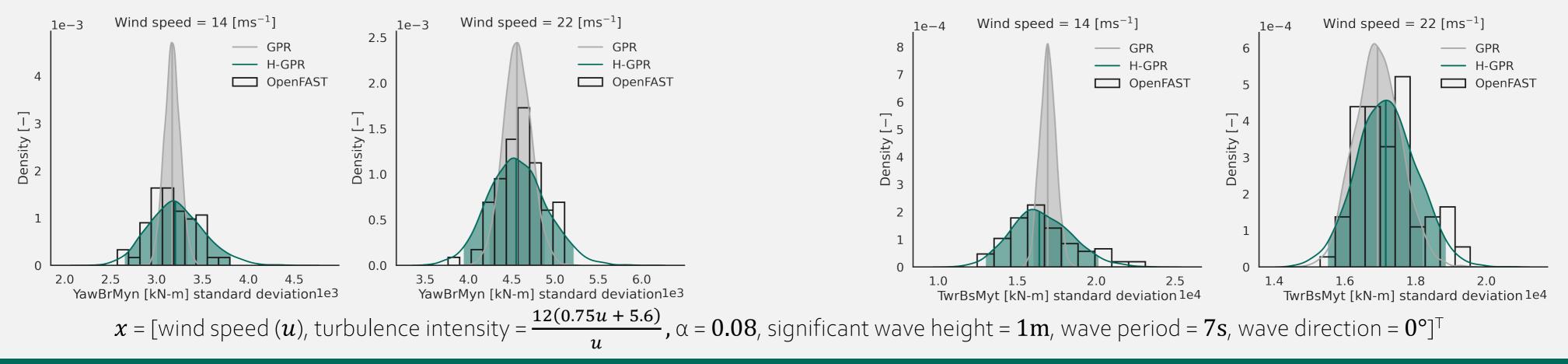
### RESULTS

The predicted conditional pdf at specific values of *x* for a **fixed-bottom offshore wind turbine** are shown. **H-GPR shows a very good agreement with the full order model** and a significant improvement over the more

#### commonly used GPR model. The work is currently being extended to floating wind turbines.



Tower base fore-aft moment (standard deviation)







This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 860737.

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