On the Use of Artificial Intelligence to Define Tank Transfer Functions

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ABSTRACT

Experimental test facilities are generally characterised using linear transfer functions to relate the wavemaker forcing amplitude to wave elevation at a probe located in the wavetank. Second and third order correction methods have been developed and can be applied to extend linear functions. However these correction methods can only be applied to certain ranges of waves. There is a growing literature [1] applying neural networks to construct numerical solution methods for partial differential equations, work that is in large part underpinned by current accelerator hardware such as graphical and tensor processing units (GPUs and TPUs). In particular neural networks have proven well suited to finding solutions for nonlinear PDEs[2].

The aim of our research is to train neural networks to represent non-linear transfer functions, F mapping a desired surface-elevation time-trace at a probe to the wavemaker input required to create it. We have investigated a wide range of sea states and wave characteristics and our work shows that it is possible to obtain the transfer functions to a high level of accuracy.

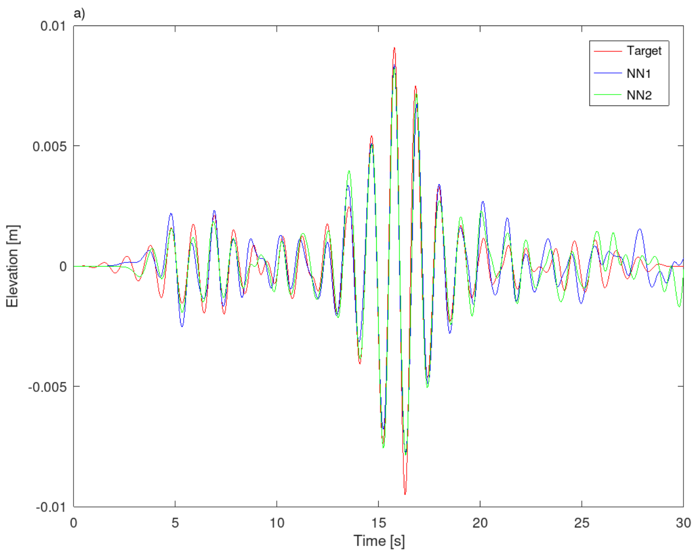

Figure 1: Solution achieved for a wave packet using different Neural Network architectures.

REFERENCES

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[2] C. Beck and A. Jentzen, *Machine learning approximation algorithms for high-dimensional fully nonlinear partial differential equation sand second-order backward stochastic differential equations*, J. Nonlinear Sci.29(2019), 1563–1619.