OPTIMIZATION OF WAVE ENERGY CONVERTING BASED ON DYNAMIC SYSTEMS MODELS

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The energy of the waves is estimated around 1 TW, worldwide. Harvesting of this enormous potential is influenced by several factors, mainly by: high values of the initial investment, changes of the weather conditions, time distribution of the wave height and the conversion devices.

Several wave energy conversion devices types are available, each one working based on different principles and offering different facilities. Choosing a particular type of converter relay on an analysis involving the initial investment value, meaning the device price, the installation and maintenance price and other unexpected expenses; all these can reach important amounts. Also, the waves present very often changes in frequency and direction, following the weather changes. As a consequence, there is no universal optimal converter, for each location being necessary studies for establishing the optimal one. This analysis is more important for closed seas, where the waves' energy is less than in the oceans.

Following the dynamic systems theory, a system is a collection of components linked together with relationships. The system behaviour is influenced both by components properties and by the links between. As a consequence, modelling and analyse of a system must be performed taking into account not just the components but the interactions between these too. Based on this theory, any real system structure can be modelled with few elements: level (acting as reservoirs), rates (acting as valves), flows (acting as links between the components) and constants (containing constants values).

Considering that the waves, with their properties (significant height and period), the energy converter device, with specific working conditions and efficiency and environmental conditions (water density and temperature, gravitational acceleration and water depth) can be considered together as a dynamic system, a corresponding model can be built and simulated.

The connections between the models' components follow the correlations between the real components: the wave power is the result of interactions between the wave height, wave period, water density and gravitational acceleration. But the wave height and wave period are influenced by the time, day, hour etc. following the chosen timestep for the simulation. All these factors are influencing also the converting device efficiency. From device side of view, the technical specifications and performances must be taken into account. In order to include into the model the forecasting of wave characteristics over the simulation time, an artificial neural network can be used.

If several devices are included into the model, the analysis of the simulation results can provide valuable information, allowing in this way choosing of the appropriate device for a precise location.

Keywords: waves energy converters, dynamic systems, modeling, optimization

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