Energy Systems in Electrical Engineering

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# OWC-Based Ocean Wave Energy Plants

## Modeling and Control

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# Contents

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# Chapter 1
# Introduction


## 1.1 The Significance of Ocean Wave Energy

It has become indispensable to explore clean and renewable energy resources, as carbon-dioxide emissions pose severe environmental dangers. A very troubled weather pattern and global warming issues seen in the last couple of years are proof of vulnerabilities that could get worse in the near future. Therefore, many clean and renewable energy resources such as hydro, solar and wind power are being used on a big scale to tackle these challenging circumstances.

Another promising source of sustainable energy to generate electricity is the ocean wave energy (Clement et al. 2002a; Zhang et al. 2009h; Brekken et al. 2011e). It was first realized in the form of tsunamis and cyclones as damaging in nature. Still, nowadays, its enormous energy potential is being used for beneficial reasons such as electric power generation (Parkinson et al. 2015e; Rusu and Onea 2016o). The potential of wave energy is estimated at around 2,000 TWh/year for the electricity generation. This share roughly comprises 10% of total global electricity demand (Rodrigues 2008; Gunn and Williams 2012c; Kumar and Anoop 2015d).

Ocean wave energy has seen slower progress over many years due to a wider tendency toward other resources and insufficient research funding. Still, the amount of research funding has increased over the past few years. It has given a strong momentum for wave energy technology growth. As a consequence, many prototypes were effectively created, and some of them also achieved pre-commercial level, such as oscillating water column (OWC), Archimedes wave swing, Pelamis, Wave dragon, etc. (Bjarte-Larsson and Falnes 2006a; Valério et al. 2007b; Falnes 2007a; Burman and Walker 2009e; Falcão 2010e; Portillo 2020; Polinder et al. 2005c; Das and Pal 2006b).

The OWC technique (Falcão and Henriques 2016d) is one of the most commonly regarded techniques by wave power researchers. Many OWC studies have been published recently covering several aspects related to OWC (Kelly et al. 2016j; Delmonte et al. 2016c; Liu et al. 2016l; Bailey et al. 2016a; Torres et al. 2016q). The simplicity is the outstanding benefit of OWC since the only moving part of the system



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