ABSTRACT

In order to design a floating OWC-type wave energy converter such as Backward Bent Duct Buoy (BBDB), it is necessary to make clear the optimal hull shape which maximizes the generating electrical energy.

In this paper, we have carried out two and three dimensional wave tank tests to obtain the optimal hull shape of BBDB. Firstly, to make clear the effect of the length of the horizontal duct to the primary conversion efficiency, we have carried out two dimensional tank tests for three types of BBDB models. Secondly, we have investigated the effect of the duct length to the draft on the primary conversion efficiency by means of two types of BBDB models. Thirdly, we have investigated the effect of the direction of incident waves on the primary conversion efficiency. Finally, the three dimensional effect on the primary conversion efficiency is investigated by comparing the difference between two dimensional tank tests and three dimensional tank tests.

KEY WORDS: Wave Energy, Floating OWC, Backward Bent Duct Buoy, Primary Energy Conversion, Experiment

INTRODUCTION

Many types of wave energy converters (WECs) that are based on various concepts have been proposed in recent years (Cruz(2008)). Various methods evaluating energy extraction from the waves by such converters are also shown (Falnes(2002)).

Recently, authors are trying the research with the aim of the practical application of Backward Bent Duct Buoy (BBDB) which is one of floating oscillating water column (OWC) type WEC. This device was invented by Masuda(1986) and consists of an air chamber, horizontal duct, buoyancy chamber and turbine as shown in Fig.1. This device has some advantages, that is, i) the primary conversion efficiency is higher than other floating OWCs, ii) as the wavelength for which primary conversion efficiency is maximum is about four times the length of the BBDB, a longer floating structure is not required. iii) as BBDB slowly advances against wave propagation direction in particular wave frequency band, the mooring force and mooring cost are reduced in irregular sea.

As BBDB has such good characteristics, the research on BBDB has been carried out in Ireland, Korea and Japan. Masuda et al.(1993), Lewis et al.(2003) and Nagata et al.(2007) carried out the wave tank tests to make clear the primary conversion characteristics of BBDB.

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Fig. 1 Principle of BBDB

EXPERIMENTAL APPARATUS AND BBDB TEST MODELS

As it was mentioned in the introduction section, we have carried out these four tests in two types of wave tanks.