

DYNAMIC AND FATIGUE ANALYSIS OF DYNAMIC CABLE (RISER CABLE) FOR FOWT – Fukushima FORWARD Project

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ABSTRACT

In the design for the dynamic cable (riser cable) system used to the floating offshore wind turbine, the dynamic behavior and the prediction of the fatigue life of the cable are important. This report deals with the adequacy of the dynamic behavior analysis using the data measured in the Fukushima FORWARD Project and the result of the study on the fatigue life prediction.

KEYWORDS

Fukushima FORWARD Project; Dynamic Cable (Riser Cable); Dynamic Analysis; Fatigue Analysis; FOWT (Floating Offshore Wind Turbine); BS (Bending Stiffener)

INTRODUCTION

Furukawa Electric have proceeded with a Fukushima floating offshore wind farm demonstration project (Fukushima FORWARD Project) as a partner of the commissioned project under the Ministry of Economy, Trade and Industry and are responsible for a transmission system (including a power and an optical transmission lines) for the whole project. In the design for the riser cable system used to the floating offshore wind turbine, the dynamic behavior and the prediction of the fatigue life of the cable are important. In this paper, the verification result of the cable behavior analysis, using the cable behavior measurement data and the floating structure motion data, for the dynamic behavior of the 22 kV cable connected to the 5 MW floating structure in the Fukushima FORWARD Project. In addition, for the 22 kV cable connected to the 7 MW and 5MW floating structure, the verification results, on the fatigue analysis using the floating structure motion data and on the fatigue analysis using both of the floating structure RAO and the oceanographic statistical data (wave scatter diagram), are reported.

DYNAMIC CABLE SYSTEM

In the design for the dynamic cable system, the undersea behavior of the riser cable is predicted by a simulation based on the oceanographic condition, the floating structure motion characteristics and the maximum movement amount of the floating structure, and a shape of the riser, a buoy, etc. are studied to satisfy the required mechanical strength, radius of curvature, durability, etc. The environmental load condition in the Fukushima FORWARD Project is shown in Table 1. The design flow of the dynamic cable (riser cable) system is shown in Fig.1. The transmission and substation system in the Fukushima FORWARD Project is shown in Fig.2. [1][2][3][4][5]

Sea depth[m]	120
Hs	11.71
Significant wave height[m] (50year)	
Ts	13.0
Significant wave period[s] (50year)	
Wind Speed[m/s] (50year)	44.1
Current Speed[m/s] (50year)	1.5

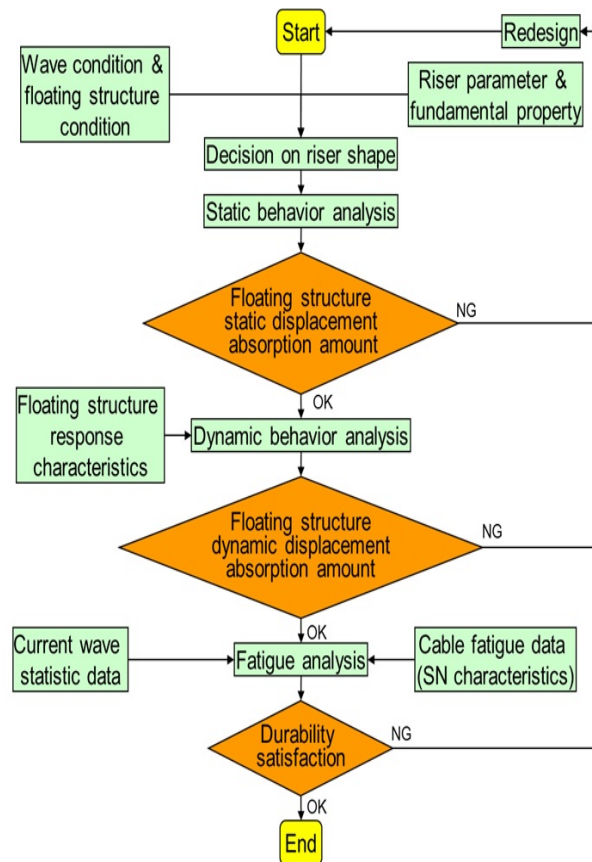


Fig. 1: Design Flow of Dynamic Cable

Table 1. Environmental Load Condition