KINEMATIC INTERACTION OF STRIP EMBEDDED FOUNDATION WITH INCOMPLETE CONTACT BETWEEN SIDEWALL AND SURROUNDING SOIL

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ABSTRACT

In the field of soil-structure interaction (SSI), Kinematic Interaction (KI) can potentially be a source of notable influences on structure dynamic response. Such influences take place through alternation in foundation input motion. In this paper, first the effect of KI on input motion for the case of single rigid strip embedded foundation with incomplete contact between sidewall and nearby soil, under vertical propagation of shear waves is investigated. Then it is discussed that how this input-change would be reflected in response spectrum. Results for different embedment depths and various soil-wall contact lengths of foundation are depicted. In this research, numerical analysis was conducted by ABAQUS, finite element software. It is shown that for high frequencies of excitation, significant intensification of input motion would be expected, as besides horizontal input, a rotational component will be generated because of embedment depth. Also it seems, an optimum sidewall contact length can be found through which, minimum ordinates of input motion would excite soil-structure systems.

INTRODUCTION

Evaluation of dynamic response of structure requires consideration of soil structure interaction. Kinematic interaction, (KI), is one of the prominent topics in the field of Soil-Structure interaction that would alter the seismic input motion. In other words, KI change the free field motion (FFM) of ground due to earthquake loading. This alternation usually modifies the frequency content and even may become a source to generate a set of input motions in new degrees of freedom (Bielak, 1974; Iguchi, 1982). A well-known example of the above phenomena is the reduction in horizontal amplitude and inducing rocking input motion to embedded foundation under vertical propagating shear waves (Mori and Fukuwa, 2012; Pais and Kausel, 1985). According to previous findings, KI would be affected by different parameters like properties of soil, shape of foundation, and depth of embedment. KI is usually quantified by transfer function (TF) which is the ratio of foundation input motion (FIM) components to free field motion in frequency domain. Veletsos and Prasad (1989) reported the effect of incident incoherent wave field on circular massless-foundation response. KI effects on embedded rectangular foundation was formulated and examined by field data (Hoshiya, 1983). Iguchi (1984) estimated dynamic response of cylindrical foundation due to variation of foundation embedment depth and incident wave angle. Gives (2012) demonstrated that the model suggested by ASCE-41 and NIST for considering KI effects were overestimated relative to those from Japanese codes to date.