# DAM-FOUNDATION INTERACTION ANALYSIS USING DECOUPLED EQUATIONS METHOD

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In order to prosperity and development of urban areas, dams as massive structure have an important role. If these types of structures fail, there can be human and financial damages. So, these structures should have more safety against natural catastrophes as earthquake. Due to complex behavior of dams, using numerical method are necessary to analys them. Since, time consuming of majority of numerical methods, developing of numerical methods are unavoidable. In this article, a new method with high efficiency is developed for soil-structure interaction (SSI) analysis, which is called Decoupled Equations Method (DEM). This semi analytical method has been developed by Khodakarami and Khaji (2011), (2012), and(2014) for potential, elastostatic, elastodynamic and wave propagation problems. This method has analytical solution in radial direction and uses a specific shape functions as interpolation function in circumferential direction. Also, boundary of problems is discretized by specific new non-isoparametric elements. In these elements, new special shape functions as well as higher-order Chebyshev mapping functions are implemented. For the shape functions, Kronecker Delta property is satisfied for displacement function, simultaneously. Moreover, the first derivatives of shape functions are assigned to zero at any given control point. In fact, for modeling geometry of the problems, we consider a local coordinate origin (LCO) to transport the geometric characteristics of global coordinate and local coordinate.

Consequently, using a form of weighted residual method and implementing Clenshaw-Curtis numerical integration, coefficient matrices of the system of equations are converted into diagonal ones, which leads to a set of decoupled partial differential equations for solving the whole system. This means that the governing partial differential equation for each degree of freedom (DOF) becomes independent from other DOFs of the domain. For solving problems in the DEM, redistributing concept is used, in which in the first step of analysis, only the DOFs that have been loaded are solved. Then, summation of tractions in LCO are calculated and the contribution of all DOFs to stiffness ratio are computed and in the second step analysis for all DOFs with new body loads are analyzed.

In this article to consider interaction of soil and structure, two LCO are used and available issue has been deliberated by applying equilibrium and compatibility conditions in interaction boundary. For applying these conditions, available stress in boundary derived by FEM and applied to soil domain paragon traction. Then, value of calculated displacement from this domain, applied to structure paragon to a boundary condition and response of structure has been computed by twice using of redistribution concept.

Finally, validity and accuracy of this method are fully demonstrated through some benchmark problems which are successfully modeled using a few numbers of DOFs. The numerical results agree very well with the results from existing numerical methods available in literature.

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