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Some Considerations on the Appropriate Dimension in the Numerical Analysis of Geoengineering Structures

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How to select the appropriate dimension in numerical analyses of geo-engineering structures is always important issue. Every structure is three-dimensional in physical space. If time is considered, the problem becomes four-dimensional. When the first author did numerical analysis of an advancing tunnel in 1986, the data-preparation and visualization were extremely difficult. Furthermore, the memory size was also a sever problem. In 1986, the memory capacity of the super computer of Nagoya University at that time was only 10 GB. The first author was asked by the computation center to have hardcopy outputs of the result of computation with a memory size of 2.5 GB and delete the computed output data files, immediately. The present tiny notebook computers have now storage capacity of several TBs. Although the memory sizes of computers increased and pre-post processing of computational results become more convenient and less laboring, it is still a major issue how to select the appropriate dimension in numerical analyses of structures. It is also fact that decisions in engineering design are still based on the rule of thumbs and/or 1 dimensional analytical or numerical analysis of structures. In this article, the authors will address this issue and compare several hypothetical and actual case histories involving tunnel face advance, man-made and natural geoengineering structures (New Ishigaki Airport, abandoned Mitake lignite mines, Karstic caves beneath Gushikawa Castle remains and Himeyuri Monument in Okinawa islands, Amenophis Pharaoh Tomb in Luxor, Cliffs at Ryukyu islands and Cappadocia)

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