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Numerical Manifold Method and its application to study crustal movements in Sichuan-Yunnan area

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For global analysis, the well known mathematical manifold is perhaps the most important subject of modern mathematics. Based upon the mathematical manifold, the numerical manifold method (NMM) was developed (Genhua Shi, 1997). This method can compute the movements and deformations of structure or materials. Both the finite element method (FEM) for continua and the discontinuous deformation analysis (DDA) for block systems are special cases of NMM.

Aim at the complex problem of continuous and discontinuous deformation across the Chinese continent, NMM is brought in to simulate the velocity field and stress field of Sichuan-Yunnan area. A restrained point's matrix and the displacement interpolation is expanded and developed for applying the NMM theory to study the crustal motions.

NMM has separate mathematical covers and physical meshes: the mathematical covers define only the fine or rough approximations; as the real material boundary, the physical mesh defines the integration fields. The mathematical covers are triangle units, the physical mesh includes the fault boundaries, joints, blocks and interfaces of different crust zones on the basis of geological tectonic background.

Based on the GPS velocity field in the Sichuan-Yunnan area, a crustal strain and stress field are simulated and analyzed. Moreover, the results show the NMM is more suitable than DDA in simulating the movement of Sichuan-Yunnan area.

Finally, a kind of mechanism of crustal motion in the Sichuan-Yunnan area is discussed in the paper.

Keywords: Numerical Manifold Method; continuous deformation; discontinuous deformation; Sichuan-Yunnan area; strain-stress field.

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