

论文

巷道稳定的协同学原理及应用技术

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摘要:

基于现有支护理论和现场支护的实际条件, 将协同学原理引入巷道支护设计, 提出协同支护的思想。协同支护是以支护的共性——系统的协同作用作为研究对象, 研究支护系统、围岩系统和环境系统等子系统及其内部的协同作用, 最终使巷道从开挖后的非平衡状态快速达到稳定的平衡状态, 其目的是最大发挥支护构件的物理力学性能, 有效控制围岩变形, 以期达到 $1+1>2$ 的协同支护作用。锚杆锚索协同支护研究以预应力为基础, 其他支护参数、结构与锚杆和锚索预应力的协同性以及锚杆预应力与锚索预应力的协同作用。高强锚杆必须与高预应力相结合, 锚杆预应力必须与锚索预应力相匹配, 只有它们之间相互合理匹配, 才能使锚杆、锚索的个体作用达到最大, 并产生协同支护的效果。对锚杆施加40 kN以上预紧力时, 与锚索140~160 kN预紧力的协同性较好; 增强锚杆的主动支护作用, 使锚杆达到60 kN以上预紧力, 此时与锚索180~200 kN的预紧力产生较好的协同性。

关键词: 巷道稳定; 协同效应; 协同支护; 预应力协同; 数值模拟

Synergetic principle for roadway stability and its application technique

Abstract:

On the basis of the existing support theories and actual support conditions, synergetic support was put forward by introducing the relevant synergetic principle to roadway support design. Synergetic support is to study the systemic synergy which includes supporting system, surrounding rock system, environment system and other subsystems, in order to make the roadway rapidly reach a balanceable and stable system from the non equilibrium ultimately. Its purpose is to maximize the physical and mechanical performance of supporting members, effectively control the deformation of surrounding rock to achieve the synergetic supporting effect of $1+1>2$. The synergetic supporting technique of rock bolts and anchor cables is mainly to study the prestressed synergy between them and the synergetic effect with other supporting parameters and supporting structures, in order to make rock bolts and anchor cables achieve maximum individual effect and bring about synergetic supporting effect. The results show that high strength rock bolts must be combined with high prestress and the prestress of rock bolts and anchor cables should match each other reasonably. Preloading above 40 kN on rock bolts and 140-160 kN to anchor cables will better the synergy. Preloading more than 60 kN on rock bolts to further enhance the active supporting character of rock bolts, at this time the preload of anchor cables must be 180-200 kN in order to better the synergy.

Keywords: roadway stability; synergistic effect; synergetic support; prestressed synergy; numerical simulation

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