矿井下着火点位置数值模拟研究

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Title: Study on numerical simulation of ignition position in underground coal mine

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摘要: 矿井煤炭自燃是煤矿五大自然灾害之一,而煤炭自燃隐蔽着火点位置的确定是解决煤炭自燃问题的关键。本文结合实际情况将火源位置的确定问题归结为热传导方程的寻源反问题。在理想状态下,把煤矿井下热传导的三维模型简化为二维模型,建立热传导方程及初始条件和边界条件,在matlab中编制了有限差分程序对井下着火点的温度场进行了正反演模拟。数值模拟结果表明:该方法能够较准确地反演出火源的特性,并随着离散化程度的提高,离散解逐渐逼近真实解。通过本文的数值模拟我们得知有限差分法求解热传导寻源反演的方法是解决矿井隐蔽火源发火点位置的有效途径之一,对矿井防、灭火研究具有较高的理论和实际应用价值。

Abstract: The spontaneous combustion of coal is one of the five natural disasters in coal mine,and the determination of hidden ignition source position is the key to solve the problem of coal spontaneous combustion.In this paper,combining with the practical situation,the problem on determination of hidden ignition source position was attributed to inverse problem of source identification in heat conduction equations.In ideal conditions,the 3D model of heat transfer in underground coal mine was simplified into 2D model,and the heat conduction equations,the initial and boundary conditions were established.The finite difference program was compiled by Matlab to conduct the forward and inversion simulation of temperature field for underground ignition point.The results showed that the method can perform the characteristics of fire source more accurately,and with the increase of discretization degree,the discrete solution approaches the real solution gradually.Through the numerical simulation in this paper,it was obtained that the method of applying finite difference method to solve the inverse problem of source identification in heat conduction is an effective way to find the position of hidden ignition source.It has a higher

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theoretical and practical application value for fire prevention and extinguishing in coal mine.

参考文献/REFERENCES

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