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论文

矿用救生舱曲线式加强筋板的设计与优化

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摘要:

针对矿用救生舱的强度问题, 提出曲线式加强筋板设计方法, 用三点作圆的方法确定加强筋板的曲线轮廓。采用3段圆弧轮廓, 代替均匀布筋方式的直线轮廓, 合理分配了加强筋板材料, 提高了救生舱壳体的强度和刚度。结合实际工程项目对设计的曲线式加强筋板进行了ANSYS有限元仿真和数值模拟分析, 针对不同工况施加不同的静、动载荷, 对比了各种情况下不同偏移量对应的等效应力、最大变形量; 分析了偏移量对救生舱壳体强度和刚度的影响, 建立了曲线偏移量与整体结构强度的定量关系。通过对曲线式加强筋板偏移量的优化设计, 获得曲线加强筋板的最优力学性能, 证明了曲线式加强筋板设计的有效性和优越性。

关键词: 矿用救生舱; 布筋方式; 曲线式筋板; 有限元分析

Design and optimization of curved stiffened panels on refuge chambers

Abstract:

A curved design for stiffened panels is proposed in this paper aimed at reinforcing the strength of shell structure. The curved contour of stiffened panels was created using the three points of a circle theory with different offset values. The stiffened panels were arranged into three arcs, instead of being positioned as straight bars. This method distributes the pressure through reallocating the rib materials, thereby improving the strength and stiffness of the shell effectively. According to the numerical simulation and finite element analysis, equivalent stress and maximum deflection was compared under different load with different offset values to show the effect of offset values on the strength of shell structure. The optimal mechanical properties were obtained by optimization designing of curved stiffened panels combined with actual engineering. The effectiveness and advantages of curved stiffened panels are proved.

Keywords: mine refuge chamber; reinforcing pattern; curved stiffened panel; finite element analysis

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