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P R E D G O V O R

ZBORNIKU RADOVA KONFERENCIJE MIT 2013

Međunarodna konferencija MIT 2013 iz oblasti matematičkih, informacionih i telekomunikacionih nauka koja je održana u periodu od 5.09 - 14.09.2013. godine pokazala je da nauka i prava prijateljstva nemaju granice.

Po treći put u Srbiji je održana konferencija MIT, koja je istovremeno i 9 Konferencija za naše suorganizatore iz Rusije.

Kroz usmene, plenarne i sekcione prezentacije, te kroz poster prezentacije, pokazali smo da uspesno pratimo svetske naučne tokove iz matematičkih nauka, primenjene matematike i informatike.

Potvrdili su Srbi, Rusi i Kazahstanci, zajedno sa naucnicima iz 14 zemalja sveta da u nauci ne postoje granice i da je znanje osnov za sve dalje naučne saradnje i ostvarenja, koja imaju za cilj dobrobit čovečanstva.

Programski komitet MIT 2013
Organizacioni komitet MIT 2013

Dr Hranislav Milošević

Beograd, april 2014. godine

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G. Pavlovic[1], M. Gasic[1], M. Rajovic[1], M. Savkovic[1]

OPTIMIZATION OF THE BOX SECTION OF THE MAIN GIRDERS OF THE BRIDGE CRANE BY USING THE METHOD OF LAGRANGE MULTIPLIERS

The paper considers the problem of optimization of the box section of the main girder of the bridge crane for the case of placing the rail above the web plate. Reduction of the girder mass is set as the objective function. The method of Lagrange multiplier was used as the methodology for approximate determination of optimum dependences of geometrical parameters of the box section. The criterion of strength were applied as the constraint function. The analysis of the optimization results and the solutions was the basis for recommendations which are significant for designers during construction of cranes.

INTRODUCTION

The main task in the process of designing the carrying structure of the bridge crane is determination of optimum dimensions of the main girder box section. The mass of the main girder has the largest share in the total mass of the bridge crane, so it is very important to perform its optimization in order to reduce the total costs of manufacturing the whole carrying structure. That is the reason why the selection of the optimum shape and geometrical parameters which influence the reduction of mass and costs of manufacturing is the subject of research of a lot of authors ([2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [13], [14], [15] i [16]).

The analysis of cost structure for manufacturing metal structures made in [2], showed that the participation of material costs in the total costs is the largest (30-73) %, and that the other costs are lower**.**

Having in mind all the above mentioned results and conclusions, the aim of this paper is to define optimum values of geometrical parameters of the box girder cross-section that will lead to the reduction of its mass.

MATEMATHICAL FORMULATION OF THE OPTIMIZATION PROBLEM

The task of optimization is to define geometrical parameters of the cross section of the girder as well as their mutual relations, which result in its minimum area. Minimization of the mass corresponds to minimization of the volume, i.e. the area of the cross section of the girder, where the given boundary conditions must be satisfied.

The optimization problem defined in this way can be given the following general mathematical formulation.

If $\vec{x}=\left[x_1,x_2,...,x_n\right]$ is vector of the given, and $\vec{y}=\left[y_1,y_2,...,y_m\right]$ is vector of variable parameters, then the objective function is expressed as $F=F(\vec{x},\vec{y})$. Observed parameters have to satisfy the limitation equations also.

$$g_s(\vec{x},\vec{y})\le 0,\ s=1,...,m. \tag{1}$$

The optimization task can be formulated in the following way: at defined vector of known parameters $\vec{x}$, there should be determined the responding values of variable parameters $\vec{y}_o=\vec{y}_o(\vec{x})$, where the objective function realizes the minimum

$$F_o=\min_{\vec{y}} F(\vec{x},\vec{y})=F_o(\vec{x}). \tag{2}$$

In this paper, variable parameters vector is $\vec{y}=\left[b,h\right]$, and the given parameters vector

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