

LINEAR PROGRAMMING TO MATERIAL OPTIMIZATION FOR PEDIATRIC ELECTRIC WHEELCHAIR CONSTRUCTION WITH PVC PIPES

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ABSTRACT

The electric wheelchair allows people with severe motor disabilities to be more independent and included in society. Although, 20 million people with disabilities worldwide do not have access to a suitable wheelchair. Due to high cost, in Brazil, Unified Health System does not grant this type of wheelchair to younger children 12 years old, and it is a relevant factor in the lack of access of this part of the population to formal education. In previous research, a pediatric electric wheelchair was developed with PVC pipes, and it was tested. In that research, one of the difficulties encountered was planning the PVC tube cutting for maximum use of material. Therefore, in this current research, a mathematical model of Linear Programming was applied to solve the problem of cutting PVC planning. In this problem, the dimensions of the PVC pipe cuts are planned from six anthropometric measurements, and these measurements may vary for each user. The mathematical model selected was the packing of backpacks. The idea is to fit objects inside backpacks, respecting the maximum weight restrictions of these backpacks. The backpacks represent the tubes to be cut and must contain tube segments. The “weight” restrictions represent each segment’s length of everything that needs to respect the raw material size limit. The model’s objective function is to minimize the number of backpacks. The model was applied in Python language in the Google Collaboratory programming environment, using the Pulp library. The system was functional for acquiring the minimum amount of tubes needed and producing cutting patterns to optimize the material. It was possible to solve a practical problem for the manufacture of a wheelchair with a mathematical model of Linear Programming. For future work, we intend development a web interface that can facilitate the use of the system by people who wish to build a low-cost wheelchair.

KEYWORDS. Linear Programming. Assistive Technology. Packing of backpacks.

PO na Área de Saúde (SA). Programação matemática (PM). Otimização Combinatória (OC). Outras aplicações em PO (OA).