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Design Analysis of Drainage Cleaning Machine

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ABSTRACT: Water is a basic need in today's world. Almost 2/3rd of the water in the world is not useful for human purposes. The main problem of urbanization is thickly populated town which doesn't have proper drainage facility. These drainages get blocked occasionally and result in foul smell and disturbs social life. These blocked drainages are presently cleaned by human labors. These drainage wastes are harmful for people and will result in several diseases.So, the need of mechanical system to replace the human labor is high. Drainage cleaning machines helps in reducing the human labor.Here designs of drainage cleaning machine analyzed using Ansys Workbench and the best design with more efficient one is selected for the fabrication.

KEYWORDS: Human labor, Drainage cleaning machine, analysis, ANSYS. machine helps in identifying the stresses acting at different points of the machine. This also helps in improving the designs and thereby reduce the weight and makes the machine less costly.

i. INTRODUCTION

Drainage Blockage is a worst-case scenario especially in India. Due to these drain blockages, even small rainfall will result in floods. These floods will flush out the waste present in the drainages out into open spaces which will be breeding spot for many diseases.When humans manually enter these drainages there will be foul smell which will result in making the laborer unconscious

As long as drainage is considered is as the main system for transporting the wastes in the households the needs of drainage cleaning machine is necessary.

II. METHODOLOGY

This design analysis of drainage cleaning machine helps in identifying the stresses acting at different points of the machine. This also helps in improving the designs and thereby reduce the weight and makes the machine less costly.

III. MODELLING

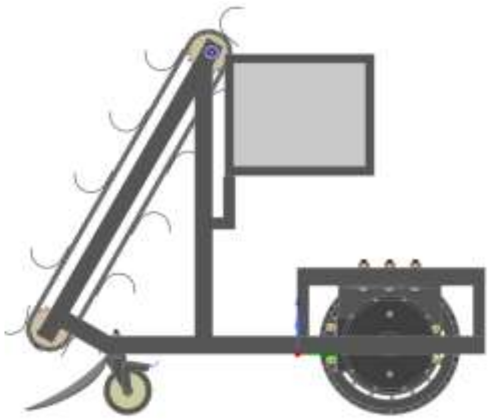

Figure 1- CAD drawing

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The above CAD drawing is imported into Ansys workbench where the boundary conditions are set and the material to be used is selected.

IV. MACHINE SPECIFICATIONS

Length of the machine = 650mm
Width of the machine = 650mm
Height of the machine = 1000mm
Diameter of the scoop = 36mm

This design analysis of drainage cleaning

V. ANALYSIS

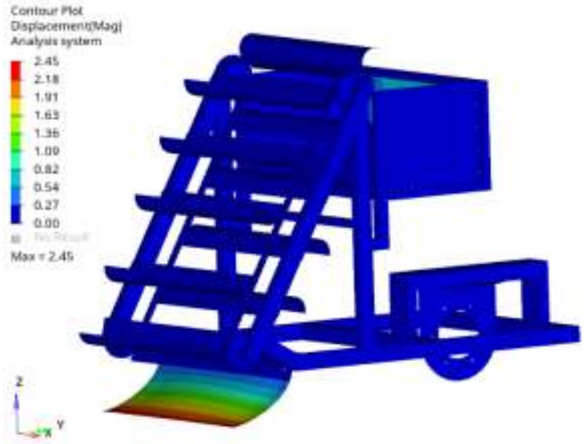

Figure 2- Displacement Analysis of Design 1

The maximum displacement in system when subjected to the load is 2.45mm.

Figure 3 – Stress Analysis of Design 1

The maximum stress in the whole system is 80.13Mpa, which is less than the yield strength of structural steel from which we can say that the design doesn't fail. The stress in the other region are less than 80.13Mpa which can be easily interpreted from contour plot. The dynamic analysis of the design was also done and the modal shapes of different parts of design at different frequencies was able plot. In design 2, the thickness at the side ends of the scoop was increased which provide an extra stiffness to the scoop and also extra area at bolting location.

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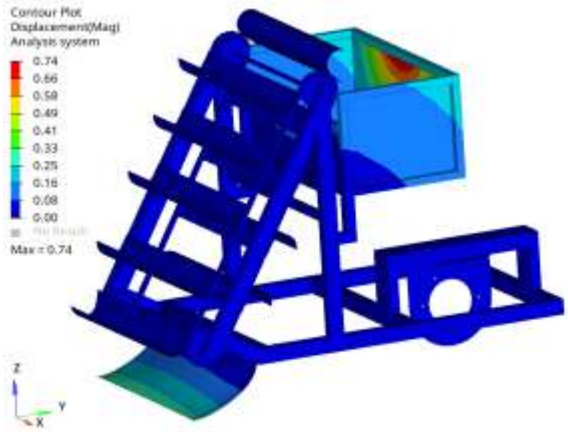

Figure 4 – Displacement Analysis of Design 2

The maximum displacement is the design 2 was reduced to 0.74mm.

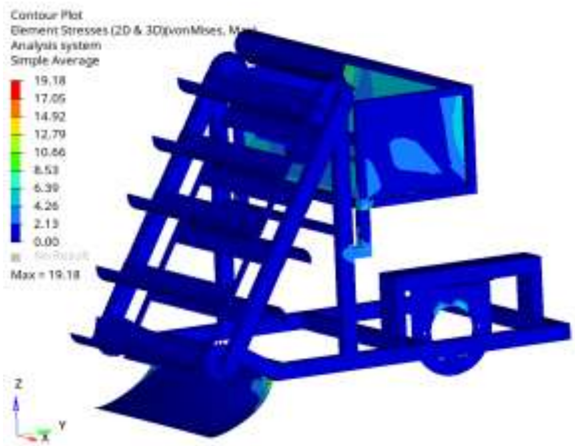

Figure 5- Stress Analysis of Design 2

The maximum stress in the whole system was reduced to 19.18Mpa by the modification made and the maximum stress in the channel was 15.13Mpa. The modal analysis for design 2 at different frequencies was done. Modal analysis helps in identifying whether the system fall near to any resonant frequencies thereby avoid such conditions. Since the stresses in the frames are very less compared to the yield strength of the material used there is chance to reduce the wall thickness of the material used in the frame. In design 3 the wall thickness was reduced from 2mm to 1.2mm which resulted in 40% reduction in the frame weight which provides a greater advantage than the other two designs. The stresses and displacement is almost similia to the other design which makes sure the design 3 is more preferable than Design 1&2.

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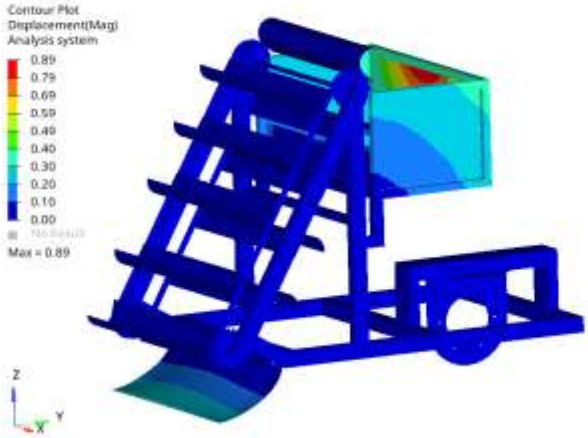

Figure 6 – Displacement Analysis of Design 3

The maximum displacement for Design 3 is 0.89mm which is lesser than Design 1 but slightly greater than Design 2.

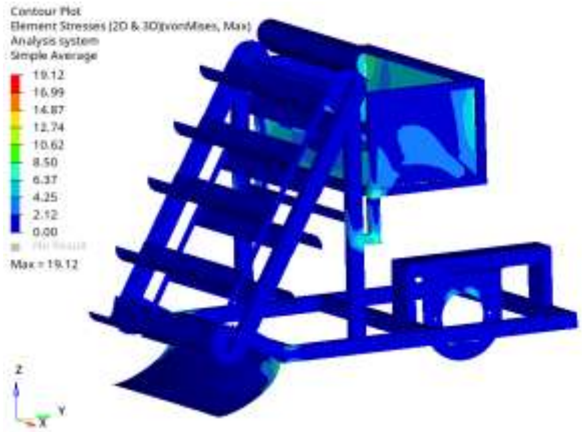

Figure 7- Stress Analysis of Design 3

The maximum stress in the whole system is 19.12 Mpa which is almost similar to the other two designs but the maximum stress in channel is 18.11 Mpa whereas the other two design had 15 Mpa. Considering all these factors we can choose Design 3.

VI. RESULT

	Design 1	Design 2	Design 3
Displacement	2.45mm	.74mm	.89mm
Max Stress	80.19Mpa	19.18Mpa	19.12Mpa
Max Stress in Channels	15.13Mpa	15.13Mpa	18.11Mpa
Weight	20.36 kg	20.36 kg	12.22 kg

VII. CONCLUSION

From results obtained, its clear that the Design 3 has the better advantages than other two designs. Design 3 is light weight than the other designs and can withstand the same load and almost has similar machine life. The analysis using ANSYS Workbench helped in determining which design are to be selected for a cost-effective product.

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