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CALCULATION OF STRESS AND STRAIN IN THE PLASTER MACHINE TROWEL

The building industry is the most important sector of the economy of any country, it accounts for 10-20% of the total national product and forms one of the largest requests for labor. The construction of industrial buildings, apartments, complexes, shops and houses is one of the main areas of work in this area. Nowadays, a large number of building processes are automated by developing machines, such as machines for pouring concrete, creating building composition and others. Since plastering is one of the main stages of the construction of the building, and their automation is a priority these days.

The existing wall plastering technique is manual, that is, the work is done using some tools, such as a flat board (trowel) or other object with a flat surface, made of metal, wood or plastic. In this process, the compound, which after acceleration is poured onto the wall with the help of a trowel, should be evenly distributed and have a smooth, good surface. This process continues a long time and takes additional human power. As a result of this, the labor process slows down and the time it takes to complete work increases. Ultimately, manual plastering has such disadvantages as high cost, increased time, material costs and bad quality of work due to unskilled labor.

Great competition in this area, the lack of qualified labor and technological progress lead to rapid changes in the building industry, stimulating its automation. The most common methods for automating plastering are:

– layer-by-layer application of the stucco compound under pressure, followed by leveling;
– mechanized plastering using plastering machines and robots.

This paper discusses a slit-type metering device for a medium-performance plastering machine. The main element of such a machine is a trowel. In the process of loading, the trowel its deflection affects the quality of applying the compound, therefore, it is necessary to choose such a thickness

that ensures a minimum deviation of the coating thickness. Due to the fact that the trowel is a plate with variable geometry and is attached pointwise, its calculation was performed numerically using the SolidWorks Simulation system. The calculation of the deflection of the trowel is made for such initial loading and fixing conditions (Figure 1).

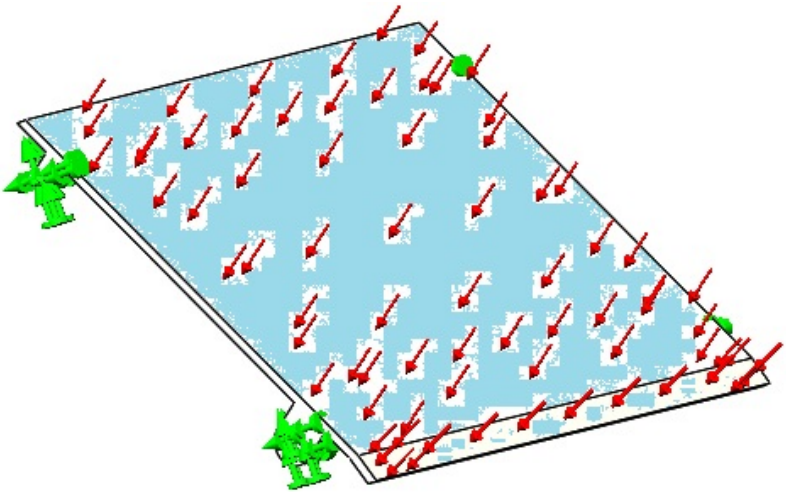

Figure 1. Loading and fixing of trowel

Trowel loads are calculated taking into account the maximum weight of the compound and the pressure of the whole system on the wall surface. As a result of the numerical calculation, the diagrams of the distribution of equivalent stresses and the deflection of the trowel in the direction of the wall surface were obtained (Figure 2, 3).

Based on the analysis of stresses and strain of the edge of the trowel, we can make the following conclusions:

– Stress in the trowel is much less than the critically permissible stress (maximum stress – 5 MPa; critically permissible stress – 531 MPa);

– The maximum strain of the trowel does not exceed 0.1 mm, which is significantly less than the tolerance of the plastering work determined (± 1 mm)

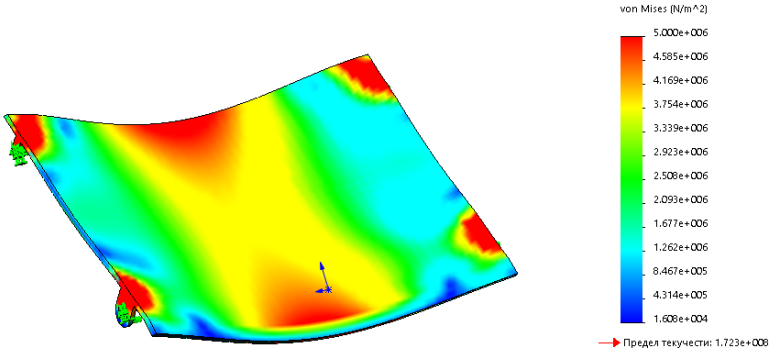

Figure 2. Diagram of the distribution of equivalent stress according to Mises

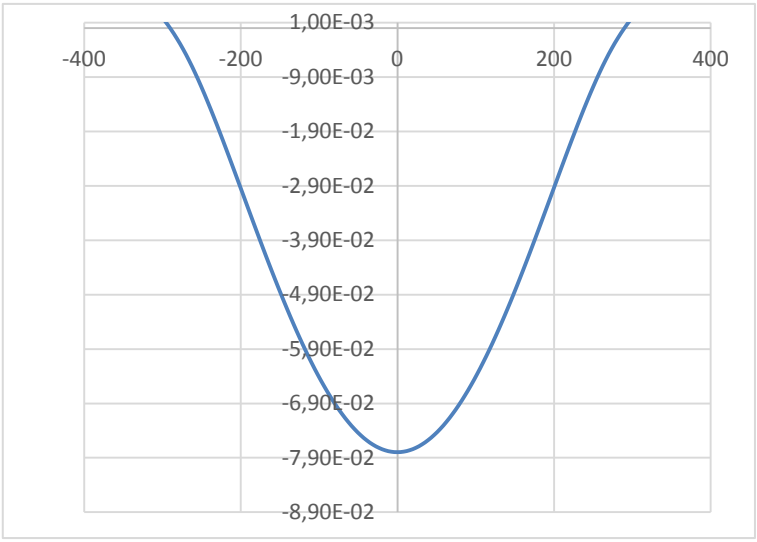

Figure 3. Schedule of strain of the trowel relative to the centerline

Further calculations showed that the thickness of the trowel can be reduced by 4 times without losing its strength and the quality of the plastering work.

Applying plaster in a mechanized way is appropriate not only at large construction projects, but also in an ordinary apartment. The application of

this method provides a significant reduction in lead time, economical consumption of materials, simplification of the leveling process. The mechanized method of applying plaster leads to savings of more than 14% and reduces the time to complete the work by 33%. In addition, we get a better quality plastered surface. However, there is the problem of the loss of the working compound, since part of it falls beyond the edges of the trowel, so in the future it would be advisable to carry out a design change and the calculations are aimed at reducing the compound consumption.

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ПРИСТРІЙ КОНТРОЛЮ СТАНУ ПРИМІЩЕННЯ

Останнім часом широкого поширення набули роботи в області створення розумних середовищ або розумного оточення для підтримки певного рівня комфорту в діяльності людини або гідного рівня життя людей похилого віку та людей з обмеженими можливостями.

Досить часто Інтернет речей є глобальною мережею сенсорних пристроїв, які збирають дані про оточення і нерідко – про людей. Звичайно, ці дані можуть бути корисними для власників пристроїв, але дуже часто вони представляють інтерес і для виробників і постачальників пристроїв. Комбінації потоків IoT-даних, що на перший погляд здаються нешкідливими, також можуть становити загрозу персональній конфіденційності. При об'єднанні або зіставленні кількох потоків даних іноді можна отримати більш точний цифровий портрет людини, ніж при використанні одного потоку IoT-даних. Наприклад, підключена до Інтернету зубна щітка може записувати і передавати нешкідливі дані про те, як її власник чистить зуби. Але якщо його холодильник передає дані про те, що він їсть, а фітнес-трекер передає дані про його фізичну активність, то комбінація цих потоків дозволяє