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Estimates for the surface with given average curvature

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Let S be a compact regular surface locally defined by equation $r = r^S(u, v)$ in R^3 . Let a function $H(x, y, z)$ be given in some locality of S . We consider a question of the existence some surface S^f homeomorphic to S , defined by an equation $r = r^S(u, v) + f(u, v)\bar{n}^S(u, v)$ and in each point A has average curvature $H(A)$. This problem has been considered in [1] (271-303) and in [2] for the case when S is a sphere or a torus.

There are coordinate system (u, v, ρ) emerges in the locality of S , where (u, v) - local coordinates on S and ρ is offset along perpendicular to S .

This problem reduces to the question of some second-order differential equation solvability on $f(u, v)$ within S . Evaluation of solution and of first derivatives of solution is required for the proof of solvability of this equation.

Let S^ρ be a surface defined by an equation $r = r^S(u, v) + \rho\bar{n}^S(u, v)$ where ρ is a constant, such that $|\rho| < c$. Here $c = \min_{(A \in S, i=1,2)} \{ \frac{1}{k_i(A)} \}$ and $k_i(A)$ are main normal curvatures of S at the point A . Average curvature of S^ρ equals $H^\rho = \frac{k_1}{1-\rho k_1} + \frac{k_2}{1-\rho k_2}$.

We represent H as the sum

$$H(u, v, \rho) = H^\rho(u, v, \rho) + h(u, v, \rho).$$

Theorem 1. *If a and b are constants and $-c < a < b < c$, and if*

$$h(u, v, \rho) < 0 \quad \text{when} \quad \rho < a,$$

$$h(u, v, \rho) > 0 \quad \text{when} \quad \rho > b,$$

there are the following estimates hold for the function $f(u, v)$:

$$a < f(u, v) < b.$$

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