# On the static calculation of biogas containers with radial and parallel cutting patterns

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Abstract

Nowadays, radial cutting patterns are common for biogas tanks above a certain construction height. The radial cutting patterns are a production challenge, especially at the polar caps. In order to avoid production difficulties, it is desirable to build plants with parallel cutting patterns. In our paper the results of a radial cutting pattern are compared and discussed with the results of a parallel cutting pattern.

Our model deals with the two membrane envelopes of a double membrane system. Together with the inner membrane (gas membrane), an outer membrane forms a chamber, the so-called air support space. Together with the silo walls and the surface of the substrate, the gas membrane forms a second chamber, the so-called gas space.

Different scenarios, e.g. the situation under internal operating pressure and the situation under a gust of wind were simulated. In the case of 'fast' loads (wind), the gas law applies. In the case of rapidly occurring loads, it must be investigated whether the outer shell and the gas membrane touch each other. The contact problem can be considered in our calculation model.

We have applied the internal pressure perpendicular to the surface for each deformed state. We also carried the wind loads with the deformations in the iterations. The material properties are defined by warp-, weft stiffness and the so-called transverse and shear stiffness in order to simulate a realistic behavior in the radial or parallel directions.

**Keywords**: Pneumatic structures, Biogas plants, Lightweight structures, Formfinding, Statics, Patterning, Gas law, Contact problem, Hybrid structures, Membranes, Foils, Force density, Optimization.