

# Optimal design problems for a degenerate operator in Orlicz-Sobolev spaces

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An optimization problem with volume constraint involving the  $\Phi$ -Laplacian in Orlicz-Sobolev spaces is considered for the case where  $\Phi$  does not satisfy the natural condition introduced by Lieberman. A minimizer  $u_\Phi$  having non-degeneracy at the free boundary is proved to exist and some important consequences are established like the Lipschitz regularity of  $u_\Phi$  along the free boundary, that the set  $\{u_\Phi > 0\}$  has uniform positive density, that the free boundary is porous with porosity  $\delta > 0$  and has finite  $(N - \delta)$ -Hausdorff measure. Under a geometric compatibility condition set up by Rossi and Teixeira, it is established the behavior of a  $\ell$ -quasilinear optimal design problem with volume constraint for  $\ell$  small. As  $\ell \rightarrow 0^+$ , we obtain a limiting free boundary problem driven by the infinity-Laplacian operator and find the optimal shape for the limiting problem. The proof is based on a penalization technique and a truncated minimization problem in terms of the Taylor polynomial of  $\Phi$ .