

Abstract Submitted  
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**Soft porous lubrication with oriented fiber array.**<sup>1</sup> ZENGHAO ZHU, QIANHONG WU, Villanova University — The friction mitigating property of oriented fibrous materials is widely observed in nature. In this paper, we propose a novel theoretical model to predict the lubrication performance due to the gliding motion of a planar surface over a soft porous layer made of oriented fibers. Lubrication theory for highly compressible porous media is used to predict the lifting force from the fluid phase. The theory for large deformation of flexible beam is used to predict the lifting force from the solid phase. The results are validated numerically using Abaqus. The relative contribution of the fluid lifting force to the overall lifting force,  $f_p$ , is then obtained, which is used as the criteria to evaluate the lubrication performance using soft porous materials. Dimensional analysis, along with a comprehensive parametric study have been performed to reveal the dominant factors that determine the lubrication performance. The study presented herein provides valuable guidance for applying highly organized porous media to soft porous lubrication.

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