

STEP II, 2003, Q9

- 9 AB is a uniform rod of weight W . The point C on AB is such that $AC > CB$. The rod is in contact with a rough horizontal floor at A and with a cylinder at C . The cylinder is fixed to the floor with its axis horizontal. The rod makes an angle α with the horizontal and lies in a vertical plane perpendicular to the axis of the cylinder. The coefficient of friction between the rod and the floor is $\tan \lambda_1$ and the coefficient of friction between the rod and the cylinder is $\tan \lambda_2$.

Show that if friction is limiting both at A and at C , and $\alpha \neq \lambda_2 - \lambda_1$, then the frictional force acting on the rod at A has magnitude

$$\frac{W \sin \lambda_1 \sin(\alpha - \lambda_2)}{\sin(\alpha + \lambda_1 - \lambda_2)}.$$



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