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

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