

Exercise 1. Bandstructure of the tilted Lieb lattice

Consider the tilted Lieb lattice shown in Fig. 1. For this exercise we are only interested in the

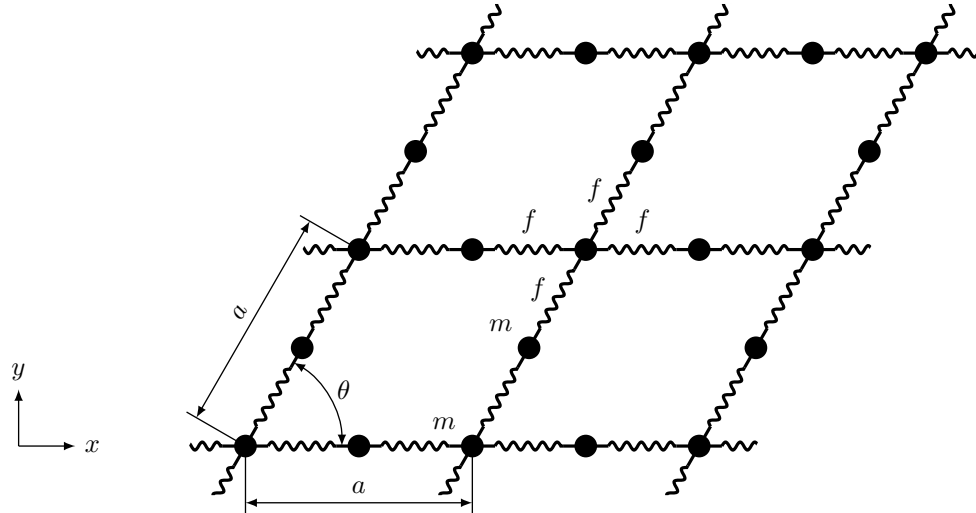


Figure 1: Tilted Lieb lattice.

out of plane degrees of freedom (z -direction) giving rise to flexural waves. We don't discuss the in-plane degrees of freedom. Importantly, f describes the effective spring constants coupling the out of plane degrees of freedom and not the actual spring constant.

- Calculate the reciprocal lattice vectors and construct the Brillouin zone of the lattice.
Hint: The form of the Brillouin zone depends on the angle θ , therefore choose a specific angle, e.g. $\theta = \pi/4$, for the construction.
- Compare the volume of the unit cell with the volume of the unit cell of the reciprocal lattice. Any relation between the two?
- Find the bandstructure of the flexural motions.
- Sketch the bandstructure for $\theta = \pi/2$.
- You should have found a flat band in (c/d). Can you use these states to transport energy through the system?