CLAIMS

[1] A piezoelectric thin-film resonator comprising:

a substrate;

a lower electrode provided on the substrate;

a piezoelectric film provided on the lower electrode; and

an upper electrode that is located opposite the lower electrode across at least a part of the piezoelectric film,

wherein a mass load film is provided on the upper electrode,

the mass load film includes a plurality of concave or convex patterns in at least a region that faces the lower electrode,

the plurality of concave or convex patterns are densely arranged in a central portion of the region and are sparsely arranged in a peripheral portion of the region, and

wherein another mass load film is provided between the mass load film and the upper electrode.

[2] A piezoelectric thin-film resonator comprising:

a substrate;

a lower electrode provided on the substrate;

a piezoelectric film provided on the lower electrode; and

an upper electrode that is located opposite the lower electrode across at least a part of the piezoelectric film,

wherein a mass load film is provided on the upper electrode,

the mass load film includes a plurality of concave or convex patterns in at least a region that faces the lower electrode,

the plurality of concave or convex patterns are densely arranged in a central portion of the region and are sparsely arranged in a peripheral portion of the region, and

wherein another mass load film is provided on the mass load film.

[3] The piezoelectric thin-film resonator according to claim 1 ~~or 2~~, wherein the upper electrode comprises the mass load film which includes concave