**Q1**: Theoretically explain and prove the relationship between z operator and s operator.

**A1**: is defined as

Thus, it maps the imaginary axis in s plane to the unit circle in z plane; the left part of the s plane is mapped into a plate within the unit circle in z plane; the right part of the s plane corresponds to the outer part of the unit circle in z plane.

**Q2**: Consider an analog plant with transfer function:

Find its equivalent digital plant transfer functions for T=0.2π and T=0.1. Can they both be used in design? (Hint: the discretized model should retain the major dynamics of the original analog model)

**A2**: Write G(s) in standard format in MATLAB:

* With ，the discretized transfer function is obtained using the Tustin approximation:

The Bode diagram is shown as follows, from which we can see that the discretized model retains the major dynamics of the original analog model.



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