Vocal Tract as a Resonator

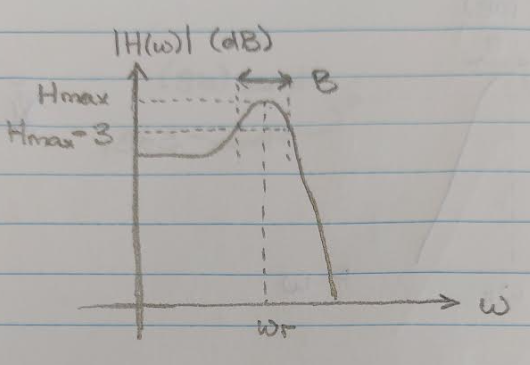
A continuous low pass resonator system has a transfer function given by

|  |  |
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|  | (1) |

where is the natural frequency in rad/s and is the quality factor, or Q-factor, given by

|  |  |
| --- | --- |
|  | (2) |

where is the resonant frequency in rad/s and is the 3dB bandwidth.



Assuming that , the transfer function can be expressed as

|  |  |
| --- | --- |
|  | (3) |

A discrete resonator system can be obtained by applying an impulse invariant mapping, which maps the poles of the s-domain transfer function to poles in the z-domain,

|  |  |
| --- | --- |
|  | (4) |
|  | (5) |

where is the sampling period in seconds.

The vocal tract filter can be modelled using a cascade of discrete low pass resonators,

|  |  |
| --- | --- |
|  | (6) |

where is the maximum number of formants that can be captured by the model, is the -th formant frequency and is the 3dB bandwidth of the -th formant.