A large number of fields use Bessel functions, including:

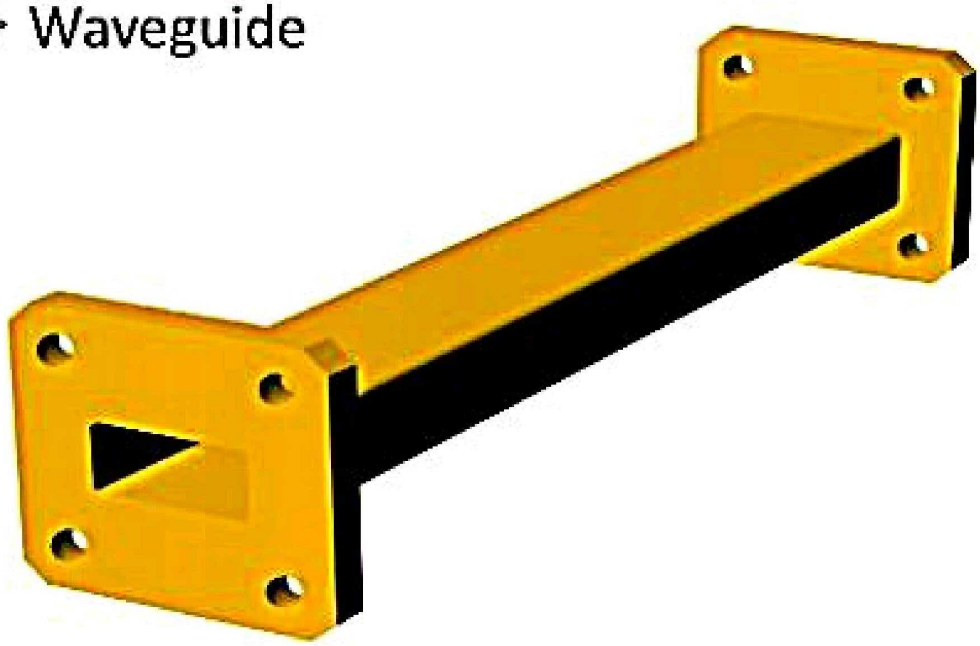
- Acoustic theory,
- Electric field theory,
- Hydrodynamics,
- Nuclear Physics,
- Radio Physics,

- Electromagnetic waves in a cylindrical waveguide.
- Pressure amplitudes of in viscid rotational flows.
- Heat conduction in a cylindrical object
- Modes of vibration of a thin circular (or annular) acoustic membrane (such as a drum or other membranophone)
- Diffusion problems on a lattice

- Solutions to the radial Schrödinger equation (in spherical and cylindrical coordinates) for a free particle
- Solving for patterns of acoustical radiation
- Frequency-dependent friction in circular pipelines
- Dynamics of floating bodies.

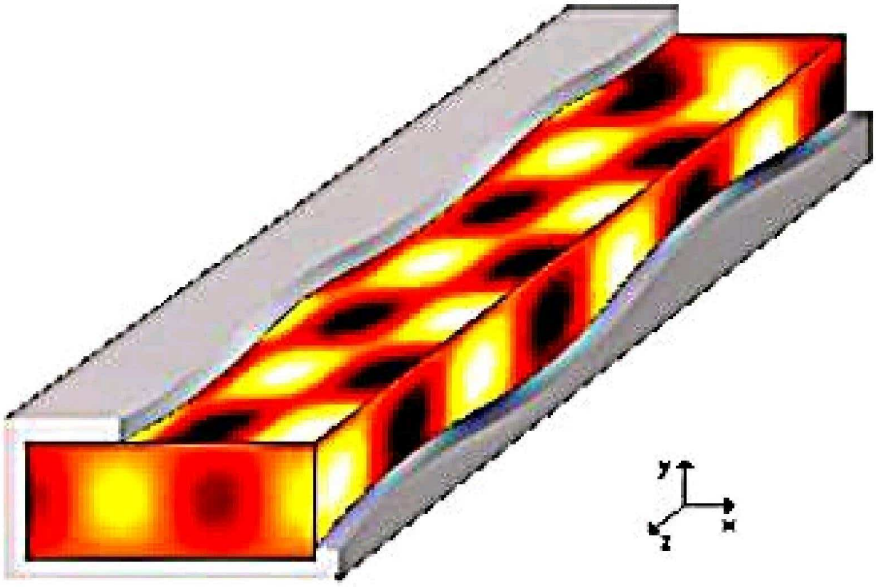
EM waves in cylindrical waveguide

- Waveguide



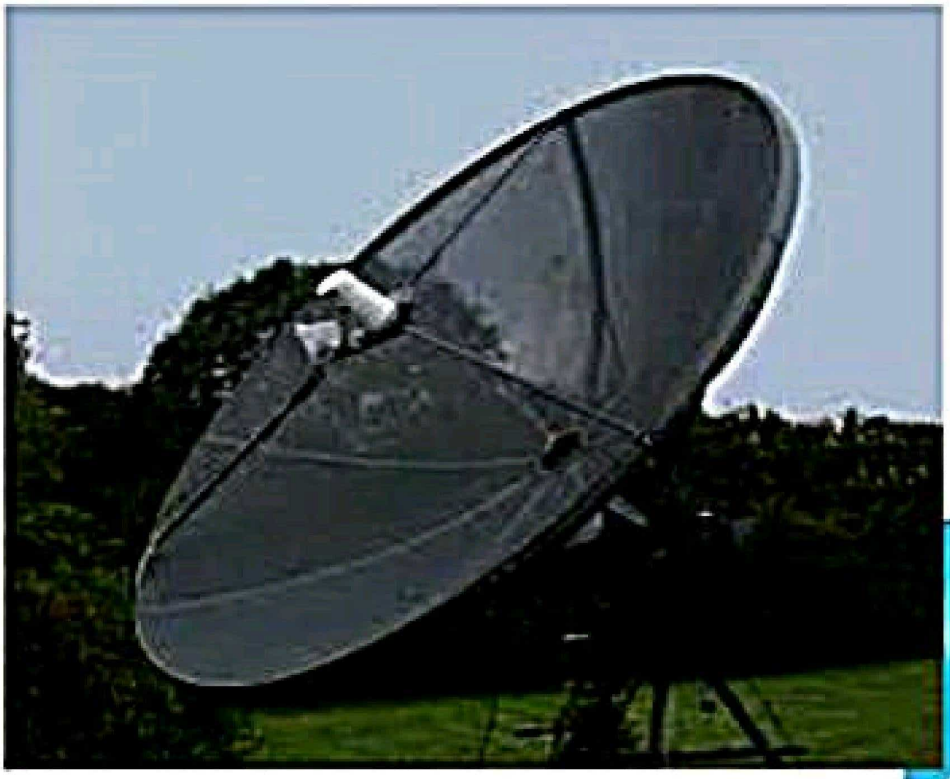
Short length of rectangular waveguide (WG17 with UBR120 connection-flanges)

- Electromagnetic Waveguide

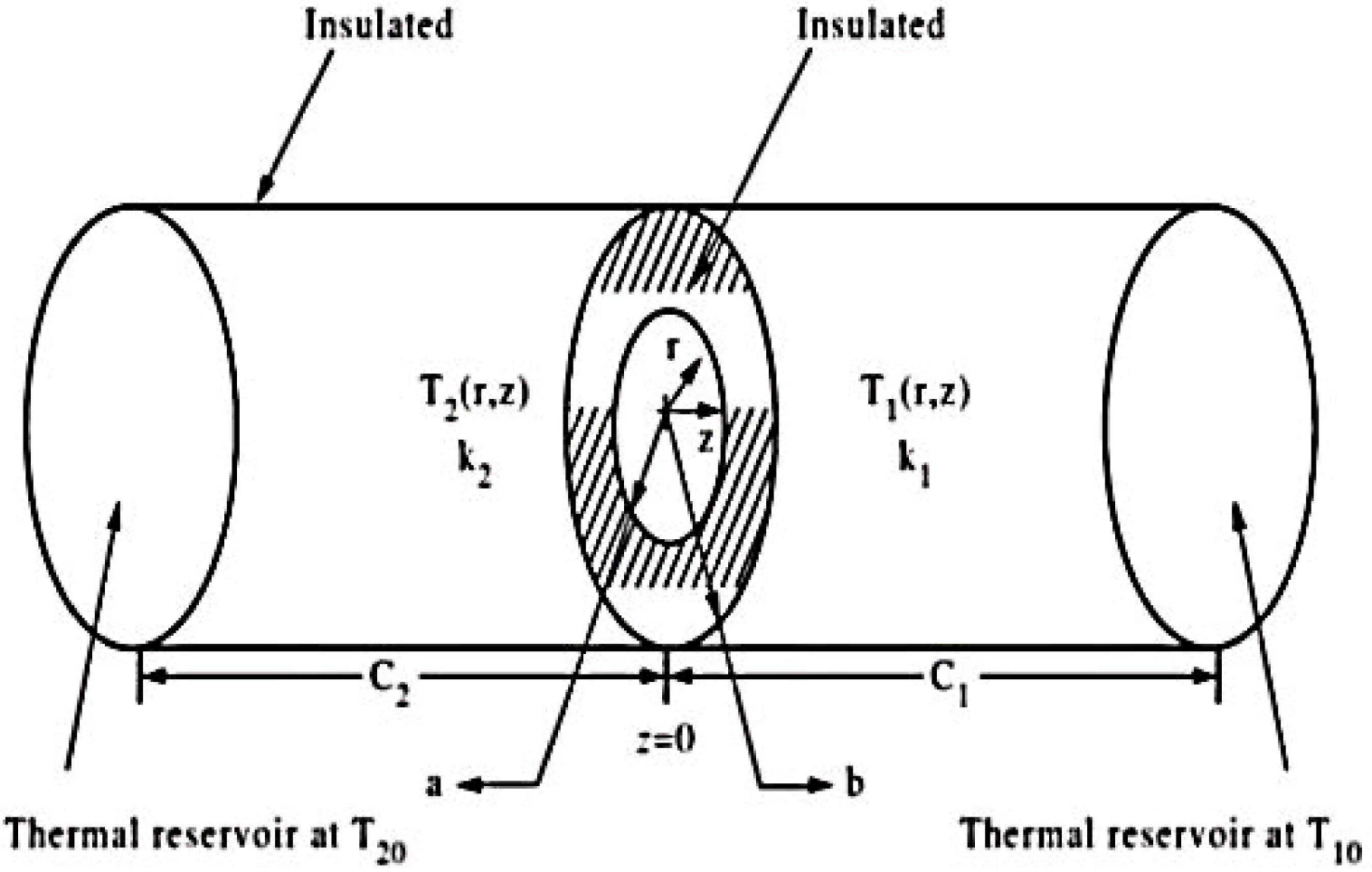


Electric field inside an x-band hollow metal waveguide.

- Cylindrical waveguide

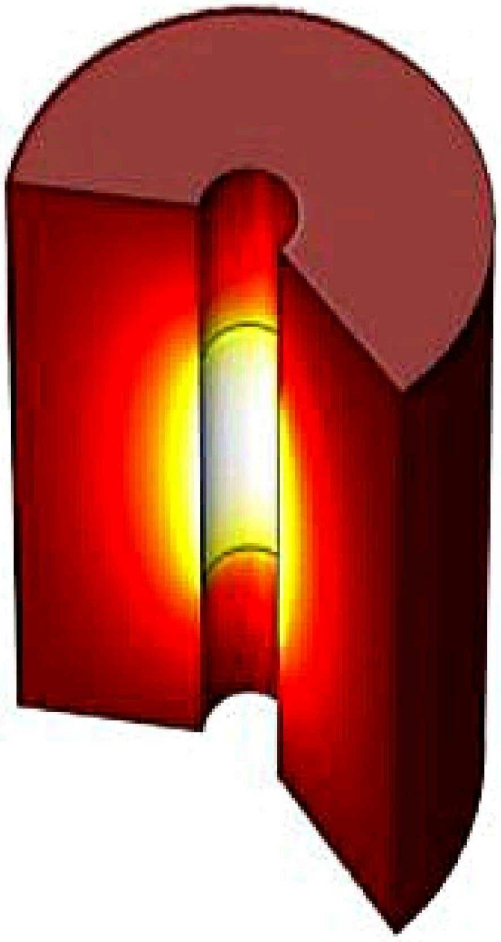


Heat conduction in cylindrical objects



- heat flow initiated within a hollow infinite cylinder at an initial condition can be generated from the roots of any type of Bessel's functions.

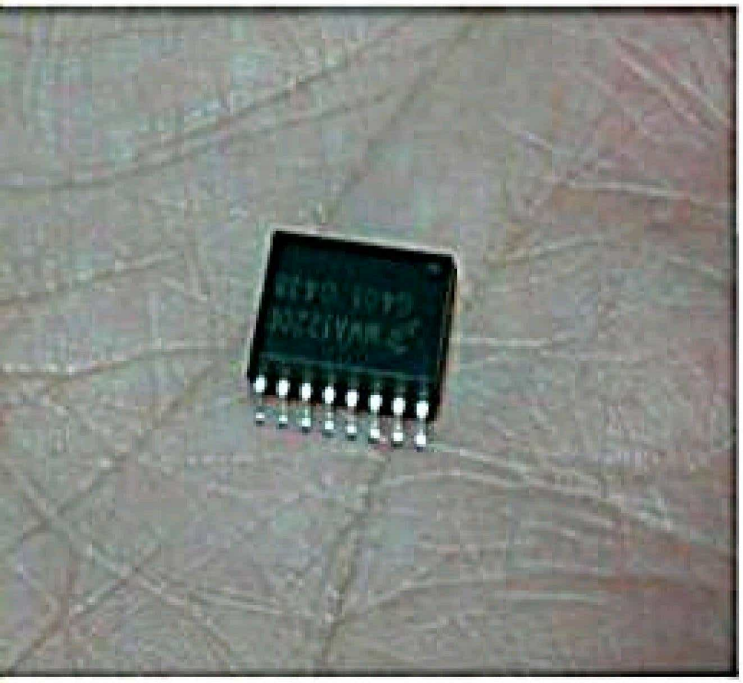
- The heat conduction equation can be solved as spherical Bessel differential equation



Application in Electronics:-

What is a Bessel filter?

- Friedrich bessel, German mathematician.
- Belongs to Electronics, signal processing
- Linear filter
- Maximally flat group delay(linear phase response)
- Used in audio crossover systems.



4th order bessel filter

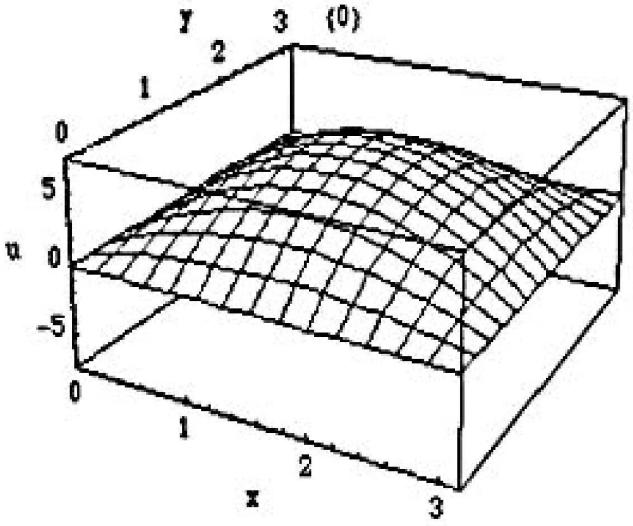
SIM965 Bessel and Butterworth Filter

How is it related to Bessel functions?

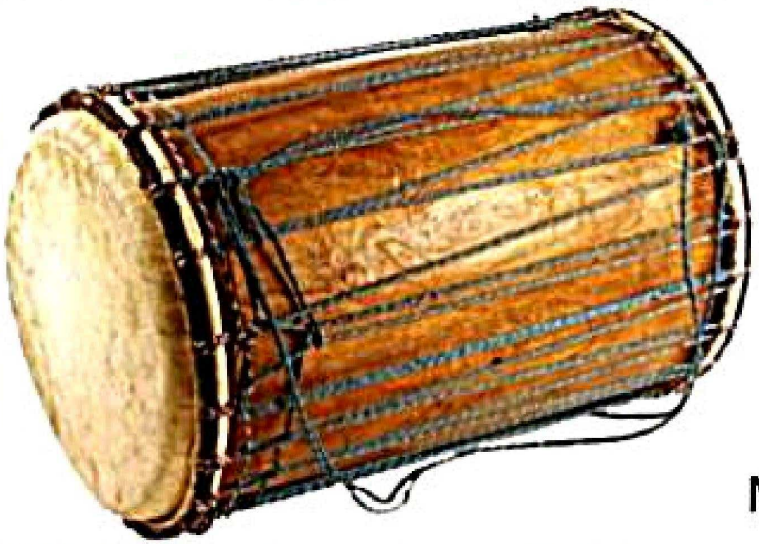
- Low pass filter is characterized by transfer function.
- Also called network function
- It's a rational function.
- Denominator is reverse Bessel polynomial.

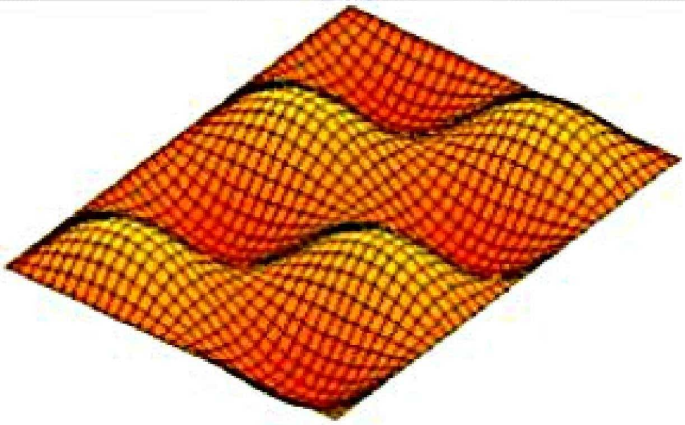
APPLICATIONS IN ACOUSTICS (such as a drum or other membranophone)

Micro-tensioned, randomly arranged cylindrical membrane



Example of membrane analysis





Membranophone and acoustic resonance in artificial membrane