

## **SIOC 204: UNDERWATER ACOUSTICS**

**Instructor: Michael Buckingham**

**Spring Quarter 2018, Tuesdays & Thursdays, 2.00 – 3.20 pm**

**Conference Room 440 Spiess Hall**

### **Basic mathematics**

Generalized functions (delta function, step function)

Linear systems (impulse response, system function)

Integral transforms (Fourier, Hankel)

Contour integration

Integrals with rapidly varying integrands (stationary phase)

Nyquist sampling theorem

### **Wave equations**

Acoustic field from a point source

Acoustic field in a viscous fluid (Stokes' equation)

Complex sound speed

Dispersion and attenuation

Causality and Kramers-Kronig dispersion relations

### **Ideal waveguide**

Normal modes

Plane wave representation of the field

Wave solution (using integral transforms)

### **Reflection from a fluid-fluid boundary**

Rayleigh reflection coefficient

Weston's "effective depth" approximation

### **Pekeris waveguide**

"Effective depth" representation

Normal modes

Solution for modal field

### **Ambient noise**

Plane wave noise fields

Spatial coherence (isotropic noise)

Spatial coherence (symmetrical and anti-symmetrical noise fields)

Spatial coherence from vertical directionality

Green's function from ambient noise

### **Acoustic arrays**

Directivity index

Array gain

Noise gain

### **Wave propagation in marine sediments**

Experimental data (compressional and shear waves)

Biot theory

Grain-Shearing theory

### **Moving sources**

Doppler frequency shifts

Field from a moving source