**EAE 298 Aeroacoustics, Fall Quarter 2016**

**Homework #3: Generalized differentiation and Farassat’s formulation   
(Due Date: 11/17/2016)**

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|  | **Name :** |  |

1. [50 points] The acoustic wave equation without considering the source is expressed as follows:

We can define a new function   using the imbedding technique as follows:

where describes the arbitrary moving body. Show that the wave equation whose sound is generated by an arbitrary moving body (=0) can be expressed as follows:

where is the unit normal vector on the surface and . Now we can use the Green’s function of the wave equation in the unbounded space, the so-called free-space Green’s function, to find the unknown function everywhere in space. The result is the Kirchhoff formula for moving surfaces.

2. [50 points] Farassat’s formulation 1 for the loading noise is given as

where This formulation 1 is difficult to compute since the observer time differentiation is outside the integrals. A much more efficient and practical formulation can be derived by carrying the observer time derivate inside the integrals (formulation 1A). Show that formulation 1A for the loading noise becomes

where .