2009-2010 EE Ph.D. Qualifying Exam
Question area: *Engineering Physics*
Examiner: *Jelena Vuckovic*

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1. Assume that there is a lossless oscillating system whose physical property *a* oscillates over time with angular frequency ω. For example, you can assume that this system represents electromagnetic field in a resonator. (However, you can also think about a mass on a spring, or another oscillating system of your choice, if it is simpler for you.)

a) Write the equation that describes the behavior of *a* over time. What is its solution?

b) If the system is not lossless, how does the property *a* vary in time? How do you have to modify the equation from the part (a) to account for losses?

c) Now assume that such a lossless oscillator is coupled to another, identical lossless oscillator. Would the system still oscillate harmonically? If yes, at what frequency?

d) Could you write equations which describe the behavior of such a coupled system?