Problem List

July 1, 2009

1. Colton: discrete complex analysis (cf Owen's paper) What's a conformal map? Homomorphism / harmonicity / zeros and poles?

2. Spaces of electrical networks – are they metrizable? Peter: They're automatically metrizable since it's a CW space. What other topolgical spaces are there? Found that $T^{-1}(\Lambda_\gamma)$ is connected – is it contractible? Homotopy groups?

3. Partial data / mixed data in inverse problems? Other discretized differential equations? Maxwell eqn an d Dirac eqn? Heat eqn? Eigenvalue / eigenvector problems? (eigenstructure often gives insight into Wave equation / Transport equation?

4. "Undoing Schur complement" in more general situations, Relaxing conditions on the matrix (not symmetric?) Arbitrary coefficients

5. Other combinatorial problems? Tom: Colorability of permutations, Recoverability in higher genus Nonorientable genus of permutations? (add in reversals?) Sara B.: Hasse diagrams Matt M.: Coxeter groups (inverse problems in biology?) Chris F.: ?

6. Origami Theory? (what are the axioms?)

   Is a subnetwork of a recoverable Γ also recoverable? That's a vague question, how do we make this precise? Of course, subnetworks of CCP graphs are recoverable, but there other statements that could be made Of interest to engineers: subnetwork emulation / replacement

7. Directed networks ("done" by Joel / Orion in 2005, Kari and Lindsay in 2007)

8. Infinite graphs / limits of networks? Continuous approximation. Brownian motion / random walks (cf Ryan Card and Eric Nitardy) Countably-infinite-to-one graphs? Parametrizing degeneracies

9. Characterization problems: Everything above – what kind of electrical networks do what? It may be possible to fully parametrize a family of networks with a certain property.

   It is possible that a couple of years ago, we fully characterized recoverable graphs with exactly 1 interior vertex, could this be extended to 2 interior vertex graphs?

10. What happens with connections on (recoverable) non-CCP networks? e.g. what happens when you contract boundary / boundary edges or boundary spikes in this situation?

11. When does one connection imply the existence of another? What sets of connections are a graph allowed to have? If two networks have the same set of connections, can they emulate one another?

12. What about annular planar graphs? Sometimes, there are non-recoverable networks which don't correspond to the usual degeneracies – where is this coming from?

13. Well defined space – circular planar with an embedding – what can we determine about this space?
14. Given the response matrix of a circular planar graph, which is perhaps in the wrong order, can you obtain the appropriate ordering of the vertices somehow? This is done if one is given the graph; but not the response matrix?
15. Obtain another family of graphs which are recoverable.
16. Konrad: How far is a graph away from being circular-planar?
17. Find an appropriate notion of criticality for non-CP graphs.
18. Discrete versions of Ting's continuous inverse problems?
19. Algorithmics: Nick Addington's algorithm: make it fast, make it better, make it work for exact cases
20. Knowing the response matrix of a CCP graph, one can actually recover the graph – not just the conductivities. Can this be generalized somehow? For example, given a restricted set of conductivities and an "arbitrary" response matrix, can you recover a (finite) network?