The formulas:

$W(M)$: Given M an $n\times n$ response matrix for a connected N (n exterior nodes)

$$W = DJ + JD - 2(-M)^{+}$$

where J = $n\times n$ all 1's
D = diagonal entries of $(-M)^{+}$

$M(W)$: Given W an $n\times n$ resistance matrix (non-zero off diagonal)

$$M = \left(\tfrac{1}{2}\left(W - \tfrac{1}{n}(WJ + JW) + \tfrac{1}{n^2}\,\mathrm{trace}(WJ)J\right)\right)^{+}$$

The onto problem for $n = 4$:

Given symmetric non zero off the diagonal,

$$W = \begin{bmatrix} 0 & a+b+f & a+c+e+f & a+d+e \\ & 0 & b+e+c & b+d+e+f \\ & & 0 & c+f+d \\ & & & 0 \end{bmatrix}$$

with $ac \geq ef$
$bd \geq ef$

show $M(W)$ is a response matrix for a circular planar N.

(use symbolic Matlab)

The range problem for $n \geq 5$

Find the range $\{W(M) \mid M \in \widetilde{EP_n}\}$

that is, M is the response matrix
for a circular planar connected network N,
with n exterior nodes.

Question: has anyone studied the
space of resistance matrices, or
resistance metrics?

Special cases might include: all resistance/
conductances are value 1.

Planar graphs? Outer-planar graphs?