

How to eliminate scale factors on a pair of matrices....

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Hello,

I'm stuck with the following problem that I can't solve.

I consider two 3-by-3 (real) matrices defined as

$$B1 = s1 * H * A1 * H^T$$

$$B2 = s2 * H * A2 * H^T$$

where $s1$ and $s2$ are non zero real numbers, H is a full-rank 3-by-3 (real) matrix (H^T denotes its transpose) and $A1$ and $A2$ are two 3-by-3 (real) matrices such that $\text{rank}(A1)=3$ and $\text{rank}(A2)\leq 3$.

I'm seeking some assumptions on $B1$, $B2$ that will ensure that

$s2/s1$ equals a known quantity ie, only depending on $A1$ and $A2$.

When $\text{rank}(A2) = 3$, it suffices to assume that

$$\det(B1) = \det(B2) = 1$$

so

$$\det(\text{inv}(B2)) * \det(B1) = (s1/s2)^3 * \det(A1) / \det(A2) = 1$$

yields

$$(s1/s2)^3 = \det(A2) / \det(A1)$$

When $\text{rank}(A2)\leq 3$, I could not think of any assumption on $B1$, $B2$ that will help me to solve the problem in a similar way.

Thanks a lot for any suggestion.