Our PnP problem is (constrained on all valid rotations matrices SO(3)):

When finding topt and substituting it back, our problem becomes:

Where

Under the assumption of , any M containing c gets zero and we left with:

And

Since , we can re-write as where:

(maybe this can be also derived from the first objective). according to this expression, M is semi positive definite. There are other matric A, such that , we get:

Now, we will parameterize rotation vector r using quaternions:

Where, using [this article](https://drive.google.com/file/d/1BZRgIC6zKYL-EUUOxnabp5eobQBSJcDO/view):

And the constraint of is replaced in .

Therefore,

Where as denoted above. Since f was squared, f2 is quadratic (in 4 variables of x) and so does p. Moreover .