

Graphics

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Transformations

Normal vectors

Remember: for column vectors A and B , $A \cdot B = A^T B$.

A normal vector N will be perpendicular (by definition) to a tangent vector V (so $N \cdot V = N^T V = 0$). When V is transformed by M to become MV , N must be transformed by a different transformation G such that GN is perpendicular to MV , so $(GN) \cdot (MV) = (GN)^T MV = 0$. Hence, as $(AB)^T = B^T A^T$, $N^T G^T MV = 0$. But from before, we also have $N^T V = 0$. Therefore,

$$\begin{aligned}N^T G^T MV &= N^T V \\G^T M &= I \\G &= (M^{-1})^T\end{aligned}$$