Following on previous analysis the effect of sequential earthquake motions was investigated. NLTH analysis was carried out on the two previously designed DCR connections to examine the cumulative damage resulting from multiple DCLS events and whether this would be enough to cause dissipator rupture. Figure 8 shows that for both design philosophies no dissipators ruptured, even when designed with a DCLS strain of 9%. This indicates that the specification of DCLS strain limits is to ensure adequate performance at the CALS and that cyclic demands arising from multiple DCLS level events do not appear to be critical.

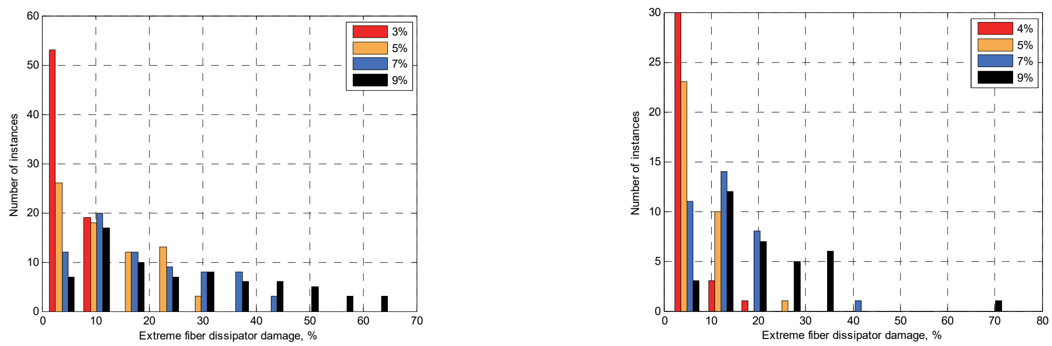

Figure 8: Damage to extreme fiber dissipators – Left: Conventional philosophy, Right: Alternative philosophy.

Conclusions

This paper has introduced an alternative design philosophy for DCR connections which ensures they are designed correctly for over-strength and improves the efficiency of the connection by reducing the DCLS design restriction. Comparison of the design philosophies through NLTH analysis has indicated satisfactory performance for both connections types. In addition, strain limits for DCLS and CALS have been proposed at 6% and 10% respectively. These limits allow for low cycle fatigue and minimize the probability of dissipator fracture at the extreme fibers. Finally, the MDCR connection was introduced as an improvement to DCR which is particularly suitable to high importance level structures in high seismic zones. MDCR will likely be able to sustain a CALS event followed by a DCLS event without collapsing. Further research on the strain limits is recommended. This research should aim to investigate near field, far field, short duration and long duration events as well as utilize a larger sample size of ground motions and connection detailing.

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