

Seismic Structural Health Monitoring Must Be Real-Time or Not?

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Abstract. The use of structural health monitoring for civil structures in seismic prone regions has advanced significantly in the last three decades. However, there is currently no consensus reached on the need of a real-time processing of the data acquired during an earthquake.

There are now numerous applications around the world whereby real-time analyses of S2HM data cannot or is not accomplished, even if many of these systems yield valuable seismic response data. There are also many studies that are performed processing such monitoring data literally years after seismic events during which the data are acquired.

Recently many advanced sensing techniques, near real-time data processing to facilitate comparison of responses with threshold criteria that define life safety or functionality have emerged and are commercially available. Hence, the question arises as to why systems that yield data that is not real-time (trigger-based, for example) are promoted as S2HM.

A question about the effectiveness of such delayed use of the seismic data arises since, if the assessment of seismic based data recorded during an earthquake is not done immediately after the event, no information can be gathered about hidden damage the structure might have experienced. That implies that the increased risk to occupants with respect to a future seismic event that occurs before the assessment of the earlier event data, is most likely bypassed.

Such risks are particularly of concern when, for example, there is long-distance long period effects. It is important to keep in mind that many long period structures (tall buildings and long-span bridges) are known to be significantly affected by events that originate at far distances and damages experienced may be hidden. This phenomenon necessitates near real-time monitored data to make timely and data-based informed decisions on the health or performance - defined by functionality and occupiability - of the affected structure. The paper discusses criteria for functionality and occupiability thresholds in actual applications.

Keywords: SHM, Real Time Data, Seismic Response.