Frontiers Topic Selection

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Coding for Polymer-Based Data Storage

"Coding for Polymer-Based Data Storage" by Pattabiraman et al. was published in the August, 2023 edition of the "IEEE transactions on information theory." Synthetic polymer data storage is a developing archival data storage technique that involves encoding binary strings using designed molecules with distinct masses. The molecules are linked using phosphate bonds to form a polymer. The data is read back using a tandem spectrometer. The authors of Pattabiraman et al. develop the "first known family of codes that allows for both unique string reconstruction and correction of multiple mass errors." Error correction is important to polymer data storage due to high read-error rates. The authors of "Insertion and Deletion Correction in Polymer-Based Data Storage" continue the research by Pattabiraman et al. by analyzing the robustness of the original approach and by proposing new codes in the cases where the original are not robust.

Sustainable Cloud Archival Storage in Glass

The article "Project Silica: sustainable cloud archival storage in glass" was published in the proceedings of the SPIE Conference "Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XXIV" in March 2024. The goal of Project Silica is to develop an archival storage technique that does not degrade over time by storing the data directly in the crystal lattice of quartz glass. The authors claim that quartz glass is "an extremely resilient media with virtually unlimited lifetime." The technology lends itself quite well to archival storage, because the data writing technique permanently modifies the structure of the glass in a way that could preserve data for over 1000 years. Due to its permenant modification, the fused-silica is considered a write-once-read-many (WORM) media. Data is stored in "voxels", which can encode 3-4 bits. By arranging these voxels in the x-y plane, and then stacking hundreds of planes, terabites of data can be stored in a square about the size of a DVD.

Compliant Foam Anvils for Equestrian Helmets

The article "Could a Compliant Foam Anvil Characterize the Biofidelic Impact Response of Equestrian Helmets?" from ASME's Journal of Biomedical Engineering takes into account the ground stiffness at different racetrack conditions to better test horseback riding helmets. Laboratory experiments consisted of helmeted forms being dropped onto natural turf using a drop rig. Multiple pieces of different synthetic foam under the turf were used. The experiments showed that the magnitudes and durations of the linear and rotational accelerations for helmeted impacts to the turf were similar to those in concussive sports falls and collisions. (The article is from 2020, but I still think that it is interesting.)

Inertial Sensors for Monitoring Equine Locomotion

The article "Applying Multi-Purpose Commercial Inertial Sensors for Monitoring Equine Locomotion in Equestrian Training" from the January 2025 Edition of Sensors introduces using commercial inertial sensor units attached to a horse's limbs to measure biomechanical load. The approach provides insights into how specific training and environmental factors can effect competitive horses. This can be utilized to optimize their exercise for specific equestrian sports and overall benefit the horses' welfare and long-term health.