PAPER TITLE

Procedural Terrain Generation Examined

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ABSTRACT

Runtime procedural generation of 2D and 3D feature geometry has become a favored technology in the real-time creation of the rendered scene at the point of need. This “just-in-time” creation of the rendered scene brings new challenges to terrain correlation and training systems interoperability.

Traditional Database Generation Systems (DBGSs) assumed the role of creating the terrain databases with all of the 2D and 3D features and formatting them for the target runtime rendering system. These DBGSs were designed to optimize the terrain databases to run efficiently on the target rendering systems. Many DBGSs create the terrain skin using Triangular Irregular Networks (TIN) techniques or similar processes, often incorporation of 3D features as constraints in the terrain skin creation process. Older runtime rendering systems even required special data constructs to enable model instancing of 3D feature models, and in some cases even instancing of 2D features to ensure runtime rendering performance, all functionality supported in these DBGSs. DBGSs even used feature scatter and procedural geometry generation techniques in their terrain database production process to reduce the cost of 3D feature model development and placement.

Relegating the creation of the terrain database to the DBGS, unfortunately, limits the management of correlation to a single DBGS. Terrain providers, who require multiple DBGSs to produce correlated content for multiple runtime systems, have resorted to scattering all features and creating all 3D feature models prior to terrain database generation. Feeding the DBGS with high resolution elevation data, cleaned and specialized feature data, a complete set of 3D feature models and construction rule constraints were required to ensure correlated content across all of the runtime terrain databases.

New training systems that employ these just-in-time geometry creation techniques are using runtime procedural generation of 3D feature models based abstract feature data and creation rules, which result in model geometry that differs between systems. The terrain skin surface is often based on gridded elevation data and algorithmically define complexity, exacerbating the correlation challenges. Moreover, these just-in-time systems are creating simple features (e.g. trees) from aggregate features (e.g. tree tract) producing data that is impossible to share with other systems.

This paper reports on the examination of the various systems, tools, processes and techniques for creating terrain databases “just-in-time” and compares the characteristics and complexities of each when used in the context of training systems, both standalone and networked. The paper first establishes the criteria for comparison, then summarizes each simulation systems characteristic, and then reports the complexities when compared to the criteria. The paper ends with a set of recommendations that are required to ensure interoperability and enable reuse of data while supporting the migration to just-in-time creation of the rendered scene content at the point of need.

BIO

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Mr. Ronald Moore is currently the Chief Architect on SE Core CVEM. He has over 35 years of experience in the model, simulation and training industry with expertise in software development, computer graphics, computer image generation, simulation geospatial terrain database production, sound simulation, streaming audio and video, and PC and console game development.