1077-15-294 **Suren Jayasuriya*** (smj20@pitt.edu) and **Pedro Perez** (perez_pedro@columbusstate.edu).
Finite-Dimensional Frame Theory over Arbitrary Fields. Preliminary report.

Frame theory has become of great importance in the past three decades, forming the theoretical basis behind signal processing and sampling theory. In 2009, Bodmann et al. investigated frames over $\mathbb{Z}_2$ in "Frame Theory for Binary Vector Spaces". Motivated by their work, we develop frame theory for finite-dimensional vector spaces over arbitrary fields $\mathbb{F}$ that may have a degenerate bilinear form. We introduce an analysis frame as a frame for a vector space such that the analysis operator $\Theta : V \to \mathbb{F}^k$ defined by $\Theta(x) = (\langle x, x_1\rangle, \langle x, x_2\rangle, \ldots, \langle x, x_k\rangle)^T$ is injective. We establish equivalent results on vector spaces that admit an analysis frame, called analysis spaces, including a reconstruction formula, Riesz Representation theorem, and existence of a dual frame pair. Defining a zero inner product subspace $ZIP(V) := \{x \in V | \langle x, y\rangle = 0 \ \forall y \in V\}$, we prove that every finite-dimensional vector space can be decomposed into an analysis space and its zero inner product subspace. This work was completed during the summer of 2011 at the Math REU program at Texas A & M University under the direction of Dr. David Larson. (Received August 18, 2011)