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A constructive extension theorem for ultraweakly continuous linear functionals

Let $\mathcal{R}$ be a linear subset of $\mathcal{B}(H)$ whose unit ball is totally bounded in the weak–operator topology (the weakest topology with respect to which the mappings $T \mapsto \langle Tx, y\rangle$ are continuous on $\mathcal{B}(H)$ for all x, y in H), and let f be a linear functional on $\mathcal{R}$ that is *ultraweakly continuous*—that is, uniformly continuous on $\mathcal{R}_1$ with respect to the weak–operator topology. We prove, within Bishop's constructive mathematics, that f has the form $T \mapsto \sum_{n=1}^{\infty} \langle Tx_n, y_n\rangle$, where the series $\sum_{n=1}^{\infty} \|x_n\|^2$ and $\sum_{n=1}^{\infty} \|y_n\|^2$ converge in $\mathbf{R}$. Not only does this provide an extension theorem for ultraweakly continuous linear functionals, but also, in the case $\mathcal{R} = \mathcal{B}(H)$, it gives a new constructive proof of the characterisation of such functionals on $\mathcal{B}(H)$.