Riesz-Schauder-Theory and Fredholm's Alternative

Theorem B5:
Let X be a normed space and $K : X \to X$.
The spectrum $\sigma(K)$ of a compact operator $K \in L_c(X) \subset L(X) := L(X, X)$ consists of at most countable many points $\{\lambda_1, \lambda_2, \dots\} \subset \mathbb{C}$ which can only accumulate at 0.
If X is infinite-dimensional then $0 \in \sigma(K)$.
$\lambda \in \sigma(K) : \lambda \neq 0$ are eigenvalues.
The corresponding eigenspace $\operatorname{Ker}(K - \lambda I)$ is finit-dimensional.

Theorm B6: Fredholm's Alternative
Ass: $K \in L(X)$ - compact, i.e. $K \in L_c(X)$,
$A = I - K \in L(X)$,
X - normed space, $\|\cdot\|_X$
St: $\operatorname{im} A = (\operatorname{Ker} A^*)^\perp$, i.e. the operator equation
Find $u \in X$: $(I-K)u = b$ in X
is solvable iff $\langle y^*, b \rangle = 0 \ \forall y^* \in \operatorname{Ker} A^*$.

PROOF: see Numerik I