In this paper measure-preserving transformations are studied by means of periodic transformations. Let $T$ be a measure-preserving transformation on a Lebesgue space $(M, \mu)$ and $f(n) \to 0$ a sequence of positive numbers. We say that $T$ has the property of approximation of first degree by periodic transformations (a.p.t.I) with speed $f(n)$, if for every $n$ there is a partition of $M$ consisting of $q_n$ measurable sets $C_{n,i}$ ($i = 1, 2, \ldots, q_n$) and a measure-preserving transformation $T_n$ such that (1) $\xi_n \to \varepsilon$ (that is, for every measurable set $A \subset M$ there is a set $A_n \in \xi_n$ such that $\mu(A_n \Delta A) \to 0$), (2) $T\xi_n = \xi_n$, and

$$\sum_{i=1}^{q_n} \mu(TC_{n,i} \Delta T_n C_{n,i}) < f(q_n).$$

We say that the approximation is of second degree (a.p.t.II) if condition 3 is replaced by

$$(3') \quad \sum_{i=1}^{q_n} \mu(TC_{n,i} \Delta T_n C_{n,i}) < f(p_n)$$

(where $p_n$ is the order of $T_n$ on the quotient space $M/\xi_n$) and the unitary operators $U_{T_n}$ in $L^2(\mu)$ converge strongly to $U_T$. We say that the approximation is cyclic if each $T_n$ is a permutation of $\xi_n$.

Here are some of the theorems proved by the authors. (1) If $T$ has cyclic a.p.t. with speed $\theta/n$ and $\theta < 4$, then $T$ is ergodic. (2) If, moreover, $\theta < \frac{1}{2}$, then $U_T$ has simple spectrum. (3) If $T$ has a.p.t.II with speed $\theta/n$ and $\theta < 2$, then $T$ is not mixing. (4) If $T$ has a.p.t.II then $T$ has discrete spectrum and all proper numbers are roots of 1. (5) If $T$ has finite entropy $h(T)$, then $T$ has a.p.t. with speed $(2h(T) + \delta)/\lg n$, with arbitrary $\delta > 0$. (6) If $T$ has a.p.t.I with speed $\theta/n$, then $h(T) \leq \theta$; if, in addition, $T$ is ergodic, then $h(T) \leq \theta/2$.

The first four theorems are extended for flows. Some category theorems are also proved and the skew product operators are studied.

The second part of the paper contains applications concerning the group property of the spectrum, square roots of transformations, flows on two-dimensional tori, and entropy of classical transformations.