SYMPLECTIC MAPS

symplectic

n-

q, p,

$$\omega = p \wedge q. \qquad (1)$$

(q_i, p_i), $i = 1, \ldots, n$,

$\omega(v, w)$ $F(q, p)$

$') = qp' + tH(q, p')$

$F = q' \; p' + p \; q$,

$$q' = q + t\frac{\partial H}{\partial p'}(q, p'), \quad p' = p - t\frac{\partial H}{\partial q}(q, p'). \qquad (4)$$

S S

H

p'. , $H = K(p) + V(q)$

,

S

(., 1).

, , ,

,

The Symplectic Group

$\{\ldots z_t, z_{t+1}, \ldots\}$

$z_{t+1} = f(z_t)$ J

f , $M = \prod_t Df(z_t)$.

f , M (2), $M^t J M = J$.

$2n \times 2n$

$Sp(2n)$. $n(2n+1)$-

,

JS S ,

t-

, ,

, $-I$. ,

( ).

(& S , 1)

M λ

M k, λ^{-1}.

$(M) = 1$, M

(λ, λ^{-1})

- *hyperbolic*, λ
- *hyperbolic with reflection*, λ
- *elliptic*, $\lambda =$ $2\pi\ \omega$
- *Krein quartet* λ

,

$(\lambda, \lambda^{-1}, \bar{\lambda}, \bar{\lambda}^{-1})$.

,

,

n

ω_i -( )2 1 0. 4 1, ∇ ∧ [∈ [= ∇ [[{ / [= ∈ [[[∈ / / / [

$m \cdot (0) \neq n$ ... m ... n.

C ... D (0), ... (n-

(1)).

1

n-

(, 1)

beyond all orders.

$n = 1$.

$\mathbb{S} \times \mathbb{R}$ (

) $\partial q'/\partial p \geq c > 0$.

ω. ω

Lipschitz graph, $p = P(q)$,

ω.

(*cantorus*

).

(

2001). (1 1)

(

& , 1 2).

(a, b, c) (., 1).

See also **Aubry–Mather theory; Cat map; Chaotic dynamics; Constants of motion and conservation laws; Ergodic theory; Fermi acceleration and Fermi map; Hamiltonian systems; Hénon map; Horseshoes and hyperbolicity in dynamical systems; Lyapunov exponents; Maps; Measures; Melnikov method; Phase space; Standard map**

Further Reading

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