MCR MOTOR CO.,LTD.

Acceleration curve of return to zero of stepper motor

1. Principle

---Definition:
Each half revolution of the motor rotor,defined as a full step. when the rotor turns 180 degree, the output shaft just turn one degree.

---Acceleration curve of return to zero:
This curve can help to quick return to zero and prevent missing step. From the start frequency of F0, after each full step, the drive frequency of motor will skip to next frequency value untill reach The last one, and then the motor will return to zero quickly. The motor should get good performance of like tingle and rebound when stoped running, if use this curve.

2. Effect factors of high speed return to zero:

The acceleration performance of motor is inverse proportion to rotational inertia.At the same time,the motor torque have relations with drive mode: if use drive IC, the motor can get large torgue,and the time of return to zero just need 14ms.If use MCU PWM signal drive by simulation miniature step,the motor will get small torgue and need 40ms time to return to zero.

3. Recommended acceleration curve of zero return
---For drive IC, according to different indicator, following 1-3 zero frequency hopping modes are recommended. It could get good performance when accelerate to 450Hz or above.
---For MCU PWM signal drive, as the power difference of PWM port supplied by MCU, we recommend customer using the fourth frequency curve mode.

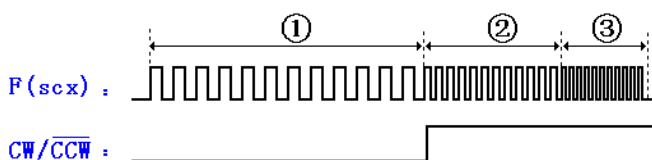| Item	Indicator inertia (kg.m2)	Time of acceleration	Name	F_0	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	F_{11}	F_{12}
1	2×10^{-7}	14ms	Indicator turn speed(°/s)	204	320	408	478	536								
			F(scx) input pulse-frequency(Hz)	2448	3840	4896	5736	6432								
			Acceleration time （ms）	4.90	3.13	2.45	2.09	1.87								
2	5×10^{-7}	22ms	Indicator turn speed(°/s)	174	275	350	412	464	510	550	582					
			F(scx) input pulse-frequency(Hz)	2088	3300	4200	4944	5568	6120	6600	6984					
			Acceleration time （ms）	5.75	3.64	2.86	2.43	2.16	1.96	1.82	1.72					
3	10×10^{-7}	30ms	Indicator turn speed(°/s)	144	230	292	344	390	429	464	496	526	552			
			F(scx) input pulse-frequency(Hz)	1728	2760	3504	4128	4680	5148	5568	5952	6312	6624			
			Acceleration time （ms）	6.94	4.35	3.42	2.91	2.56	2.33	2.16	2.02	1.90	1.81			
4	$>10\times10^{-7}$	40ms	Indicator turn speed(°/s)	124	200	257	302	342	377	409	438	465	490	513	534	554
			F(scx) input pulse-frequency(Hz)	1488	2400	3084	3624	4104	4524	4908	5256	5580	5880	6156	6408	6648
			Acceleration time （ms）	8.06	5.00	3.89	3.31	2.92	2.65	2.44	2.28	2.15	2.04	1.95	1.87	1.81
Remarks		1.This acceleration curve use STI6606 drive IC. 2.F(scx) input 12 pulses, when the motor runs full step, input pulse frequency skip: Fi -> Fi+1. 3.Acceleration time calculation: each full step moving time equal to ∑12/F(scx).															

Chart 1 Input pulse sequence of drive IC

Remark:STI6606 IC input pulse F(scx), each 12 pulses is a full step, and switch a frequency, ①②③ are the acceleration process, on the contrary is deceleration process.
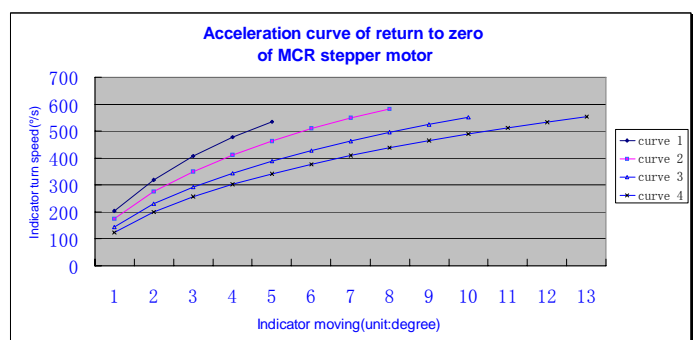

Chart 2 Acceleration curve

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