Description of trajectories						
Production						
trajectory	Within this variant, measurements are taken during the production trajectory of the robot. The length of one measurement equals one production cycle.					
Measurement trajectory with isolated long movements	Using this trajectory, isolated movements with preferably large angle range are executed for each axis for the measurement.					
Measurement trajectory with combined short movements	Using this trajectory, a combined movement of all axis in a small angle range (< 10° per axis) are executed for each axis for the measurement.					
Measurement trajectory with force excitation	Using this trajectory, the robot is decelerated as quick as possible from a movement with high velocities by using the robot's mechanical brakes. The measurement is taken during the remaining mechanical oscilation of the robot after the braking procedure.					

	Economic efficiency			
	<u>'</u>			
Please compare the programming effort for the different trajectories (3	smaller effort, 2 same effort, 1 larger effort)!			
		Measurement		1
		trajectory with	Measurement trajectory	Measurement
		isolated long	with combined short	trajectory with force
	Production trajectory	movements	movements	excitation
Production trajectory			3	3
Measurement trajectory with isolated long movements		1		2
Measurement trajectory with combined short movements		1	2	
Measurement trajectory with force excitation		1	2	2
Please compare the effort for hardware changes to be able to execute	the different trajectories automatically (3 smaller e	ffort. 2 same effort. 1 larger effort)		
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			_
		Measurement		
		trajectory with	Measurement trajectory	Measurement
	Braduction trainctons	isolated long movements	with combined short movements	trajectory with force excitation
Book are construent.	Production trajectory	movements		3
Production trajectory Measurement trajectory with isolated long movements		1	-	2
Measurement trajectory with isolated long movements Measurement trajectory with combined short movements		1	2	2
Measurement trajectory with force excitation		1		1
Measurement trajectory with force excitation		1	1	1
		T		
		Measurement		I
		trajectory with	Measurement trajectory	Measurement
	Book attacked and	isolated long	with combined short	trajectory with force
Production trajectory	Production trajectory	movements	movements	excitation 3
		1		2
Measurement trajectory with isolated long movements Measurement trajectory with combined short movements		1	2	4
Measurement trajectory with force excitation		1		2
Weastrement trajectory with force excitation		-1		4
Please compare the additional time needed during production to execu	te the trajectories (3 less time, 2 equal time, 1 mor	e time)!		
		Measurement		1
		trajectory with	Measurement trajectory	Measurement
		isolated long	with combined short	trajectory with force
	Production trajectory	movements	movements	excitation
Production trajectory	i-roduction trajectory	movements		3
Measurement trajectory with isolated long movements		1		1
		1		-1
Measurement trajectory with combined short movements		1	3	

	Data quality						
Please compare the influences of movements by other axes on the measurement data for a specific axis (3 minor influence, 2 equal influence, 1 major influence)!							
		Measurement					
		trajectory with	Measurement trajectory	Measurement			
		isolated long	with combined short	trajectory with force			
	Production trajectory	movements	movements	excitation			
Production trajectory			1	2 2			
Measurement trajectory with isolated long movements		3		3			
Measurement trajectory with combined short movements		2	1	2			
Measurement trajectory with force excitation		2	1	2			
Please evaluate to what extent the trajectory can be used to identify da	amage of specific parts (o.g. bearing sing) (2 bighe	or cuitability. 3 oqual cuitability. 1 los	or cuitability)				
riease evaluate to what extent the trajectory can be used to identify do	amage of specific parts (e.g. bearing ring) (5 mgne	er suitability, 2 equal suitability, 1 lov	ver suitability):				
		Measurement					
		trajectory with	Measurement trajectory	Measurement			
		isolated long	with combined short	trajectory with force			
	Production trajectory	movements	movements	excitation			
Production trajectory			1	1 1			
Measurement trajectory with isolated long movements		3		3 3			
		-		3			
Measurement trajectory with combined short movements		3	1	2			
Measurement trajectory with combined short movements Measurement trajectory with force excitation		3	1	2 2			
	amage in functional groups (e.g. gears) (3 higher s	3 suitability, 2 equal suitability, 1 lowe	1	2 2			
Measurement trajectory with force excitation	amage in functional groups (e.g. gears) (3 higher s	3 suitability, 2 equal suitability, 1 lowe	suitability)!				
Measurement trajectory with force excitation	amage in functional groups (e.g. gears) (3 higher s	3 suitability, 2 equal suitability, 1 lowe Measurement trajectory with	suitability)! Measurement trajectory	Measurement			
Measurement trajectory with force excitation		suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long	suitability)!	Measurement trajectory with force			
Measurement trajectory with force excitation	amage in functional groups (e.g. gears) (3 higher s	3 suitability, 2 equal suitability, 1 lowe Measurement trajectory with	suitability)! Measurement trajectory	Measurement			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify do Production trajectory		suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long	suitability)! Measurement trajectory with combined short	Measurement trajectory with force			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify day Production trajectory Measurement trajectory with isolated long movements		suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long	suitability)! Measurement trajectory with combined short	Measurement trajectory with force			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify do Production trajectory		suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements	suitability)! Measurement trajectory with combined short	Measurement trajectory with force			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify day Production trajectory Measurement trajectory with isolated long movements		3 suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3	suitability)! Measurement trajectory with combined short movements 1	Measurement trajectory with force			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify display to the second of t		Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3	Measurement trajectory with combined short movements	Measurement trajectory with force excitation 1 2 2 2 2			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify described by the second of	Production trajectory	suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3	suitability)! Measurement trajectory with combined short movements 1 2 2	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify display to the second of t	Production trajectory	suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3	suitability)! Measurement trajectory with combined short movements 1 2 2	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify described by the second of	Production trajectory	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 3 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	suitability)! Measurement trajectory with combined short movements 1 2 2	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify described by the second of	Production trajectory	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 on the considered trajectory (3 sma	suitability)! Measurement trajectory with combined short movements 1 2 2 2 ler influence, 2 equal influence,	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2 1 larger influence)!			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify described by the second of	Production trajectory	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 on the considered trajectory (3 sma Measurement trajectory with trajectory with trajectory with trajectory with	Measurement trajectory with combined short movements 1 2 2 2 Ider influence, 2 equal influence,	Measurement trajectory with force excitation 1 2 2 2 2 2 2 2 1 larger influence)!			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify described by the second of	Production trajectory Production trajectory pry have an influence on the measurement based	suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 3 0 on the considered trajectory (3 small Measurement trajectory with isolated long	suitability)! Measurement trajectory with combined short movements 1 2 2 ler influence, 2 equal influence, Measurement trajectory with combined short	Measurement trajectory with force excitation 1			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify discontinuous control of the production trajectory Measurement trajectory with isolated long movements Measurement trajectory with combined short movements Measurement trajectory with force excitation Please compare in how far program changes of the production trajectory	Production trajectory	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 on the considered trajectory (3 sma Measurement trajectory with trajectory with trajectory with trajectory with	Measurement trajectory with combined short movements 1 2 2 2 Ider influence, 2 equal influence,	Measurement trajectory with force excitation 1 2 2 2 2 2 2 2 1 larger influence)!			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify discovered to to i	Production trajectory Production trajectory pry have an influence on the measurement based	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Measurement trajectory with combined short movements 1 2 2 ler influence, 2 equal influence, Measurement trajectory with combined short movements	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify display to the second of t	Production trajectory Production trajectory pry have an influence on the measurement based	suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 3 on the considered trajectory (3 small Measurement trajectory with isolated long movements 3 a mall Measurement trajectory with isolated long movements	suitability)! Measurement trajectory with combined short movements 1 2 2 ler influence, 2 equal influence, Measurement trajectory with combined short movements	Measurement trajectory with force excitation 1			
Measurement trajectory with force excitation Please evaluate to what extent the trajectory can be used to identify discovered to to i	Production trajectory Production trajectory pry have an influence on the measurement based	Suitability, 2 equal suitability, 1 lowe Measurement trajectory with isolated long movements 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Measurement trajectory with combined short movements 1 2 2 2 2 Measurement trajectory with combined short movements 1 Measurement trajectory with combined short movements 1 2 2 2 2 2 3 4 4 6 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Measurement trajectory with force excitation 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			

Results						
	Economic efficiency	Data quality	Overall			
Production trajectory	4,00	1,56	5,56			
Measurement trajectory with isolated long movements	2,11	3,56	5,67			
Measurement trajectory with combined short movements	2,44	2,78	5,22			
Measurement trajectory with force excitation	2,11	2,78	4,89			

